APPENDIX 3

# SUMMARIZATION OF ENVIRONMENTAL REGULATIONS, AGREEMENTS AND PROGRAMS IN THE UNITED STATES, CANADA, ONTARIO AND MICHIGAN

UPPER GREAT LAKES CONNECTING CHANNELS STUDY
REGULATORY TASK FORCE
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## A. INTRODUCTION

This report contains a summarization of major environmental regulations, agreements and programs currently in effect in Michigan, Ontario, the U.S. and Canadian federal governments and bi-nationally. Regulations, agreements and programs which affect water quality are most strongly emphasized; however, an overview of those not directly related to water quality are also presented. In addition to providing an overview, this report hopes to be useful as a source of information, conveying potential avenues which are available to effect ecosystem quality changes in the Upper Great Lakes Connecting Channels.

## B. WATER QUALITY REGULATIONS OR GUIDANCE

### 1. BI-NATIONAL

The United States and Canada have a history of cooperation with regard to the Great Lakes Basin area. The Great Lakes Water Quality Agreement (GLWQA) between the two governments was entered into in 1972 for the purpose of restoring and enhancing water quality of the Great Lakes System. Subsequent reports by the International Joint Commission (IJC) and agency experience in implementing the 1972 Agreement led to the Great Lakes Water Quality Agreement of 1978, with amendments in 1985 and 1987. Under the Agreement, the two governments are committed to the development of programs, practices and technologies to gain a better understanding of the Great Lakes Basin ecosystem.

The Agreement contains both general and specific objectives to fulfill the Agreement's purpose. The general objectives aim to maintain and augment water quality by ensuring that boundary waters of the Great Lakes system are free from substances resulting from human activity which would adversely impact human, animal or aquatic life, are unsightly or deleterious, or interfere with beneficial uses of the water.

The specific objectives of the Agreement are numerical values for selected chemical, physical, microbiological and radiological parameters which represent the minimum levels of water quality desired in the boundary waters of the Great Lakes system (Table 1).

Various annexes contained in the GLWQA outline specific programs aimed at improving or maintaining water quality in the Great Lakes Basin. Many of these annexes are discussed in other sections of this report.

## 2. CANADA

The Fisheries Act is the most significant federal statute for the protection of fish habitat from chemical pollution. Promulgated in 1977, the habitat protection provisions of the Act provide for the protection of fish and fish habitat from disruptive and destructive activities. Section 33(2) of the Act provides comprehensive powers to protect fish, fish habitat and man's use of fish by prohibiting the discharge of deleterious substances to waters of Canadian fisheries and is legally enforceable when an impact on fish or fish habitat can be shown. A deleterious substance is defined by Section 33(11) as any substance or water that has been processed or changed which, if added to the system, would degrade the quality of the water so that it is rendered deleterious to fish or fish habitat.

Regulations have been promulgated under the Fisheries Act addressing certain industrial sectors: meat and poultry products, potato processing, petroleum refining, chlor-alkali mercury, pulp and paper and metal mining. In addition, there is one recent regulation governing the use of fish toxicants in fishery management programs.

The Canada Water Act provides for water quality management authorities under agreement with the province of Ontario. The Canada-Ontario Agreement Respecting Great Lakes Water Quality (COA) covers water quality objectives, central programs, monitoring requirements and shared cost programs. This agreement is a public contract between the federal and provincial government in which those governments agree to undertake and coordinate activities within their jurisdiction to fulfill the GLWQA requirements.

The Canadian Environmental Protection Act (CEPA) was proclaimed in June of 1988. CEPA strengthens environmental protection in Canada through the assessment and evaluation of new and existing chemicals, the development of new regulations for better management of chemicals and the implementation of an enforcement and compliance policy for consistent applications of the law. New Substance Notification Regulations including biotechnology information requirements, and Export Notification Regulations are undergoing public review at this time.

## 3. ONTARIO

The provincial government of Ontario developed a water management program in 1978 under Ontario Water Resources Act entitled "Water Management - Goals, Objectives, Policies and Implementation Procedures of the Ministry of the Environment." This program discusses surface water and ground water quality and quantity management issues. The Program was revised in 1984, and a second revision is currently in progress.

The program establishes provincial water quality objectives (PWQO) to protect aquatic life and recreational uses; included in these are the specific objectives of the GLWQA. The PWQO parameters, presented in

Table 1, include conventional pollutants, inorganics, metals, and organics. The objectives apply to all areas except mixing zones contiguous to a point source. The terms and conditions of mixing zones are determined on a case-by-case basis based on the water body's dilution and assimilation capacity for wastes. Provincial drinking water objectives are also established under the authority of the CWRA, and consist of a health-based Maximum Acceptable Concentration (MAC), and a Maximum Desirable Concentration (MDC) for aesthetic qualities of drinking water, presented in Table 2.

Ground water used for livestock watering or for irrigation should meet the Water Quality Criteria for these uses. These criteria are limited to conventional parameters and metals. Ground water contributing to stream flow should meet the PWQO for the protection of aquatic life.

4. UNITED STATES

The National Environmental Policy Act of 1969 (NEPA), as amended, is the US government's basic national charter for the protection of the environment (7 CFR Part 1b). Its purpose is to state a national policy which encourages harmony between man and the environment, promotes efforts to prevent or eliminate damage to the environment and fosters a greater understanding of ecological systems. It requires that certain major federal actions prepare an environmental impact statement describing significant impacts which could result from the action. NEPA also establishes the Council on Environmental Quality. While NEPA generally has not resulted in regulations for specific media, it forms the foundation upon which all media- and action-specific environmental laws and regulations are built.

Regulations pursuant to the federal CWA have resulted in the USEPA Ambient Water Quality Criteria (AWQC), contained in Table 1. These concentration limits describe recommended upper limits of contaminant concentrations for both acute and chronic impacts on aquatic life. There is also AWQC for Human Health, based on consumption of 2 liters of water and 6.5 gm of fish per day, or 6.5 gm of fish per day only. The U.S. CWA provides the authority for states to develop ambient water quality standards and a State Water Quality Management Plan (40 CFR Parts 131 and 132). Water quality standards are state goals for individual water bodies, which are developed by considering the designated use of the water body and setting criteria at levels necessary to protect that use. Water quality standards also serve as a regulatory basis for treatment controls and strategies, such as water quality-based effluent limits. Water quality standards may be either numerical or narrative. States have responsibility for reviewing and revising water quality standards to ensure that they are adequate to protect the water's designated use. The standards adopted by the state are subject to review and approval by USEPA on (at least) a triennial basis, and 1987 amendments to the CWA requires states to explicitly address all parameters covered in USEPA guidance. States are also required to adopt a state-wide antidegradation policy to ensure that high quality waters will be maintained and protected.

State water quality standards and pollution control programs must satisfy minimum requirements for approval (and funding) by USEPA. The states may direct the implementation of programs to identify and prioritize point and non-point source water quality problems, and address their remediation. These programs include establishment of a total maximum daily load (TMDL) for water quality-limited waters, establishment of effluent limitations for point sources, non-point source management controls, identification and development of plans for control of ground water pollution, and others. A monitoring program is required, and must include monitoring methods, such as biological monitoring, and procedures appropriate to assess the quality of water. The state must submit a biennial water quality report, including lists of water quality-limited and impacted waters, the effect of control programs on water quality, and other items.

The Safe Drinking Water Act (SDWA) of 1974, as amended by the SDWA Amendments of 1986, provides for control of the quality of drinking water by authorizing the USEPA to establish National Primary Drinking Water Regulations (NPDWR) for contaminants known or suspected of causing adverse human health effects (40 CFR Part 141). Two types of primary standards have been established. Maximum Contaminant Levels (MCLs), which are enforceable numerical standards for specific contaminants, are based, in part, on health effects, but also include consideration of treatment technology, laboratory analytical capabilities and cost. Maximum Contaminant Level Goals (MCLGs), which are also numerical limits, are set at concentrations at which adverse health effects are not expected to occur. Thus, on the basis of a non-threshold theory of carcinogenicity, USEPA has established MCLGs of zero for Group A and Group B carcinogens. MCLGs are non-enforceable goals; however, the SDWA directs the USEPA to set MCLs as close to MCLGs as feasible. The SDWA also directs development of National Secondary Drinking Water Regulations. These regulations establish recommended maximum levels for aesthetic qualities of water, such as odor, color and taste, in public water systems which would affect the public's acceptance of the water. These regulations are not enforceable, but are intended as guidelines for the states. National Primary and Secondary Drinking Water Regulations are contained in Table 2.

The SDWA regulations specify monitoring and analytical requirements for regulated contaminants in public water supplies. These requirements vary with the type of public water supply system (community or non-community), the size of the population served, and the source of the water (ground or surface water), as well as with the pollutant considered.

The SDWA regulations have effectively imposed a ban on the use of lead for pipes, solders and flux in the installation or repair of public water systems, or in plumbing in facilities connected to a public water system (40 CFR Part 141.43). Solders and flux cannot contain more than 0.2% lead; pipes and pipe fittings not more than 8% lead. It is also required that public water systems identify and notify people who may be exposed to lead in their drinking water. This ban became effective on June 18,

1986. The lead notification took effect in June 1988, and is enforced by the state.

The Underground Injection Control (UIC) program regulations are promulgated under the SDWA (40 CFR Parts 144-147). This program allows the USEPA to protect underground sources of drinking water (USDW) by regulating the injection of material into sub-surface geological formations through a permit program. The SDWA regulations effectively prohibit any underground injection that is not authorized by permit or rule. It prohibits any injection activity which would result in a contaminant concentration above the National Primary Drinking Water Regulations, or that may otherwise adversely affect the health of persons. If certain USDW supplies have the potential to be contaminated by an injection activity, the regulations authorize the USEPA to respond by taking corrective or enforcement action. The UIC program regulates five different classes of wells. Criteria and standards applicable to each class of well vary, and are outlined in the regulations.

5. MICHIGAN

The Water Resources Commission Act, (Act 245), as amended, is the basic water pollution control statute in the State of Michigan. This statute sets the framework for the state to regulate pollutants from point and non-point sources, and to establish water quality standards and designated uses for Michigan's water resources. Under this statute, there are two primary rules which have been promulgated to deal with water quality issues. The first of these are the Part 4 rules of the Water Resources Commission, the Michigan Water Quality Standards. These standards establish water quality requirements applicable to all surface waters of the state. The standards aim to protect the public health and welfare, and enhance, maintain and protect the quality of water for recreation, public water supplies, agricultural, navigation and use by fish and other aquatic life and wildlife. The Michigan Water Quality Standards are generally narrative standards aimed to limit concentrations of contaminants which would be injurious to designated uses of the water. Standards for some conventional pollutants, such as total dissolved solids, dissolved oxygen and temperature, are described in numerical terms.

Within the Part 4 rules, Rule 57 addresses toxic substances in waters of the state. This rule is a narrative water quality standard as opposed to a numerical rule which would have absolute values specified for a list of toxic substances. The rule is divided into two subrules. The first, 57(1), is a general narrative statement prohibiting levels of toxic substances which are, or may become, injurious to the public health, safety or welfare, plant and animal life, or designated uses of the waters. Allowable levels of toxic substances are determined by the use of appropriate scientific data.

The second subrule, 57(2), specifically addresses development of allowable toxicant levels in waters of the state applicable to point source discharges. Rule 57(2) was developed to protect human health,

fish and wildlife from exposure to toxicants in surface water. It is a narrative rule for the calculation of "edge-of-the-mixing-zone" concentrations for toxics, and is intended to be used in determining allowable levels for point source discharges. However, MDNR uses the Rule 57(2) values as goals, particularly where ambient concentrations are in excess of these values. Rule 57(2) values are water body-specific, where appropriate, and are based on the most restrictive of human health, fish or wildlife criteria. Rule 57(2) values may not be appropriate if ambient water quality exceeds Rule 57(2) values. In these cases, Rule 98, Antidegradation, may be more appropriate.

The Michigan Wetlands Protection Act (Act 203), calls for the preservation, management and use of the state's wetland resources. The Act prohibits certain activities within wetlands unless permitted, and provides for penalties and other enforcement actions for violations. The Michigan Shorelines Protection and Management Act instructs the Water Resources Commission to manage and protect shoreline areas which are subject to flooding and erosion, are necessary for the preservation and maintenance of fish and wildlife or otherwise need protection. The Inland Lakes and Streams Act (Act 346) requires permits for certain operations, such as dredging or filling, structural changes to an inland lake or stream, or marina developments. Michigan Act 61, referred to as the Oil and Gas Act, requires operation of all production and disposal wells in the state in such a manner so as not to pollute or impact state fresh water resources. Michigan's Great Lakes Submerged Lands Act (Act 247), regulates the sale, lease and use of unpatented lake bottomlands and unpatented made lands in the Great Lakes to prevent substantial impact on public use of the land, such as fishing, boating or swimming.

## C. BIOTA QUALITY REGULATIONS OR GUIDANCE

### 1. BI-NATIONAL

The GLWQA, in its specific objectives, has developed fish tissue contaminant levels which should not be exceeded, to protect the human and animal consumers of fish (Table 4). Specific objectives are established for persistent pesticides, lead, mercury and PCBs. The specific objectives refer to concentrations in edible portions of fish, wet weight, for all contaminants except DDT, mercury and PCB, which are based on whole fish concentrations.

### 2. CANADA

The federal Food and Drug Act authorizes Health and Welfare Canada to establish fish consumption guidelines for fish in commerce. Restricted consumption for the general population and no consumption for women of child-bearing age and children under the age of 15 is advised for fish exceeding the guidelines, which are also contained in Table 4.

## 3. ONTARIO

The Ontario Ministry of Environment and Ontario Ministry of Natural Resources annually issue the "Guide to Eating Ontario Sport Fish," providing fish consumption recommendations adopted from federal guidelines. In addition to federal guidelines, Ontario also has developed a guideline for lead. Guidelines are based on, in most cases, contaminant concentrations in skinless, boneless dorsal fillets. These provincial guidelines are summarized in Table 4.

## 4. UNITED STATES

The Federal Food, Drug and Cosmetic Act (FFDCA) authorizes the establishment of residue tolerances (maximum allowable limits of residues) for unavoidable deleterious substances in foodstuffs, including fish (40 CFR Part 180). These tolerances are based on public health and human food loss considerations, and have been developed for scores of substances. Tolerances for pesticides whose registered uses have been cancelled can be revoked, and an action level, recommended by the USEPA, instated in its place. In general, an action level is a level of contamination below which the FDA will take no enforcement action. Various factors, such as surveillance data, toxicology and analytical capabilities, may be considered in the development of an action level. Action levels set by FDA for fish reflect an average national consumption figure, since the aim of the FDA's limitation is to control these commodities in interstate commerce. Action levels are also used by other agencies (e.g., U.S. Food and Drug Administration) in their regulatory programs. Tolerances and action levels of chemicals in fish are presented in Table 4. Individual state water programs may also set specific water quality criteria to prevent influences on human health through consumption of fish flesh.

Great Lakes Public Health Fish Consumption Advisories are also issued by the U.S., developed and agreed to by each of the Great Lakes states. The Great Lakes Toxic Substance Control Agreement initiated the development of a format for a common sport fish advisory for the Great Lakes states, which is hoped to be used bi-nationally, to promote consistency.

Considerable legislation, not directly related to environmental quality, exists to protect aquatic and terrestrial biota. The Endangered Species Act of 1973 (16 USC 1531 et seq.) provides for the conservation of endangered and threatened terrestrial, avian and aquatic species through recovery plans, utilizing methods such as habitat acquisition and maintenance, propagation and similar measures. Other acts include the National Wildlife Refuge System Administration Act, which regulates activities (e.g., hunting) for the protection of fish and wildlife and designates National Wildlife Refuges, and the Migratory Bird Treaty Act (16 USC 703 et seq.), which regulates hunting and selling of specific migratory birds.

5. MICHIGAN

Michigan's Department of Public Health (MDPH) and Department of Natural Resources (MDNR) annually issue a Public Health Fish Consumption Advisory. The advisory is published in the MDNR annual Michigan Fishing Guide which accompanies each fishing license sold. The Advisory contains both "restricted consumption" and "no consumption" advice categories for specific types and sizes of fish in thirty five water bodies within Michigan, with more stringent recommendations for women and children. The Michigan Public Health Fish Consumption Advisories are based on MDPH Trigger Levels, which are often similar to, but derived independently of, FDA action levels. Michigan Trigger Levels are shown in Table 4, and may apply to skin-on or skin-off fillets, depending on the fish species.

D. SEDIMENT QUALITY REGULATIONS OR GUIDANCE

The GLWQA, in Annexes 7 and 14, addresses sediment quality from the perspective of studying, evaluating and monitoring dredging activities and inplace, contaminated sediments within the Great Lakes system, but has not derived specific objectives for contaminants in sediments. There are presently no US or Canadian standards for contaminant concentrations in sediments. However, guidelines for the disposal of dredged material, based on contaminant concentrations in sediments, have been established by the Ontario MOE 1978 revised Guidelines for Dredged Spoils for Open Water Disposal and the USEPA Guidelines for the Pollutional Classification for Great Lakes Harbor Sediments. The Ontario MOE allows open water disposal of dredged materials that meet or are lower than the established guidelines, providing existing water uses are not affected. The USEPA Region V guidelines were developed under pressure for the need for some guidelines, have not been adequately related to the impact of sediments on lakes, and should be considered interim guidelines until more scientifically sound guidelines are developed.

Since sediment quality guidelines do not exist, these dredging guidelines are often used in place of sediment criteria. Since contaminated sediments constitute a significant environmental concern in the Great Lakes basin, these guidelines are under review by most agencies. Regulations which address dredging and remediation of contaminated sediments are discussed in a later section.

E. POINT SOURCE CONTAMINANT CONTROL

1. Industrial Point Source Control

Ground and Surface Water

i) BI-NATIONAL

The Great Lakes Water Quality Agreement, in Article VI, established the responsibility of the governments of Canada and the United States to develop and implement programs for the abatement, control and prevention

of pollution resulting from industrial point sources. The establishment of pollutant-specific effluent limitations, the control of thermal, radioactive and persistent toxic substance discharges, and an effective enforcement program are all requirements of the Article.

The 1987 Amendments to the GLWQA added Annex 16, entitled "Pollution from Contaminated Ground Water." The Annex calls for, in part, control of the sources of ground water contamination, and could be applied to point source discharges to ground water.

ii) CANADA

Federal guidelines for effluent quality and waste water treatment at federal establishments apply to all effluents discharged from land-based establishments under the direct authority of the federal government, excluding vehicles and vessels. These guidelines have been developed and are administered by Environment Canada, and are revised and amended periodically to reflect new developments in technology and changing circumstances. Effluent guidelines for waste water from federal facilities are to be equal to or more stringent than provincial standards. The guidelines contain both general and specific limits, and apply primarily to domestic-type effluents. General limits describe qualitatively the quality of the effluent (e.g., it should free from materials harmful to aquatic life). Specific limits set numerical concentrations for conventional pollutants, and are shown in Table 4.

Federal effluent regulations and guidelines for various industrial sectors are promulgated under Section 33 of the Fisheries Act, and are based on the application of best practicable technology. In general, regulations set national effluent limitations that apply to new and expanded plants, and guidelines set minimum acceptable standards that apply to existing plants. The Petroleum Refinery Liquid Effluent Regulations and Guidelines (1974) limit pH, oil and grease, phenols, sulphide, ammonia-nitrogen, total suspended matter and acute toxicity in discharges per production rate. The Pulp and Paper Effluent Regulations (1971) limit total suspended solids, oxygen-demanding decomposable organic matter (BOD5) and toxic wastes discharged by new and expanded Kraft, sulphite or semi-chemical mills. The regulations are also applied to existing mills as guidelines. The Fisheries Act regulations and guidelines have not been promulgated for other major sectors, such as organic chemical, iron and steel industries.

iii) ONTARIO

Onatrio establishes and enforces effluent requirements at least as stringent as the federal requirements. In addition, provincial environmental objectives are implemented under the Environmental Protection Act (EPA) and the Ontario Water Resources Act (OWRA) using voluntary measures, formal programs, Control Orders, Directions and Requirements, Certificates of Approval and prosecution.

The objectives established under OWRA for the Control of Industrial Waste Discharges in Ontario set out desirable effluent discharge characteristics in order to protect receiving water quality. These objectives apply to industrial direct dischargers only, and limit conventional parameters, metals, phenols and toxic substances. These objectives are presented in Table 5. Equivalent limits also apply to industries discharging to combined sanitary/storm sewer systems. Site-specific Requirements and Directions may also be issued under Section 5.1 of the OWRA.

Certificates of Approval (C of A) for treatment works are issued under the OWRA. In the past, a C of A was an approval to install pollution control equipment with the design specifications shown in the C of A. Recently, some approvals include legally enforceable effluent limitations, as well.

Legally enforceable Control Orders may be issued under Section 113 of the EPA to any existing plant. Control Orders define tasks and compliance dates by which specific tasks must be completed.

The Guidelines for Control of Industrial Phosphorus Discharges in Liquid Effluents, issued under EPA, are intended to provide guidelines for phosphorus discharges and water quality management consistent with municipal sewage systems. The objective of 1 mg/l phosphorus concentration in industrial effluents is based on the use of practicable control technology. Facilities discharging one million gallons per day or more of effluent are subject to the phosphorus limitation of 1 mg/l.

In June, 1986, the provincial government published a White Paper entitled "Municipal-Industrial Strategy for Abatement (MISA)." This paper describes a control program based on best available technology economically achievable and receiving water quality to reduce the discharge of toxic organics from industrial direct dischargers and municipal water pollution control plants (WPCPs). Under the MISA program, a Monitoring and Reporting Regulation will set legal requirements for submission, accuracy and reliability of self-monitoring information (including sampling and analytical protocols). This new regulation will specify a list of pollutants and a set of sampling schedules for each defined industrial and municipal sector. When implemented, the regulations will expand the available data base on toxic substances and result in greater uniformity in reporting.

Subsequent to MISA, as per the schedule shown in Table 6, the Ministry of the Environment will also be formulating effluent limit regulations for each industrial sector and the municipal sector, based on the best available technology economically achievable. The data collected under the Monitoring and Reporting Regulations will be used to establish these limits. Receiving water quality-based requirements will be determined and the more stringent of the water quality-based or technology-based limits will be imposed.

iv) UNITED STATES

The National Pollution Discharge Elimination System (NPDES) program, developed from the Clean Water Act, enables the USEPA, or administering (delegated) states, to control the discharge of pollutants from point sources into waters of the U.S (40 CFR Parts 122-129). Control is maintained by requiring point sources to obtain permits, which regulate the amount of contaminants discharged into the receiving stream. There are four sub-categories of control programs under the current NPDES program: municipal and industrial, pretreatment, federal facilities and general permit programs.

The Municipal and Industrial Permit Program regulates individual point source discharges of municipal and industrial waste water. Permits are generally comprised of four components: effluent limitations, monitoring requirements, standard and special conditions.

Effluent limitations are limits placed on the mass or concentration (or both) of pollutants, or some other characteristic of the waste water outfall. Effluent limitations can be based on the Standard Industrial Code (SIC) of the industry, which rely on best available technology economically achievable for non-conventional and toxic pollutants, and best conventional pollution control technology for conventional pollutants. Alternately, effluent limitations can be based upon the protection of water quality. New Source Performance Standards (NSPS) are effluent limitation guidelines applicable for new industrial direct dischargers. These standards represent state-of-the-art treatment technology, and include, where practicable, a standard permitting no discharge of pollutants.

The Industrial Pretreatment Program (IPP) sets pretreatment standards for commercial and industrial sources which discharge waste water into the sewer system of a municipal waste treatment facility, rather than directly into surface water. The pretreatment standards to which these indirect dischargers must comply are usually chemical-specific numerical standards, may be based on specific industrial categories, and are issued to the industry by the municipal facility or the state. The purpose of setting pretreatment standards is to prevent interference with the municipal facility operation, pass-through of pollutants, contamination of municipal sludge and exposure to workers.

Control of pollutant discharge from federal facilities is performed in a manner similar to non-federal facilities. However, classification of federal facilities is sometimes different from industrial or municipal facilities, resulting in different requirements.

General permits may be used to cover a specified class of dischargers within a defined geographic area, e.g., storm sewers. One permit is issued to the class of dischargers; however, it contains the same limitations as would be found in individual permits.

The Safe Drinking Water Act (SDWA) establishes the Underground Injection Control (UIC) program. Through this program, the USEPA protects underground sources of drinking water by regulating the injection of material into sub-surface geological formations through a permit program. This program was discussed in a previous section.

v) MICHIGAN

The Michigan Water Resources Commission Act (Act 245), as amended, requires the discharge of any waste water to the state's water resources to be authorized by a discharge permit issued by the Water Resources Commission (WRC). This permit requirement for waste water sources deals not only with surface water, but also with ground water discharges. The primary intent of such permits is to set effluent limits and other restrictions that will prevent the degradation of surface and ground water quality.

Ground Water Discharge Permit applications must include a hydrogeological study unless a waiver is granted by the WRC. The permitting process includes a technical evaluation by the MDNR staff and a public notice and comment period. Final permits are issued by the WRC.

Michigan has administered the National Pollutant Discharge Elimination System (NPDES) program since October of 1973, when delegation was granted by the USEPA. The NPDES permit process controls the direct discharge of pollutants into surface waters of the state.

Michigan's NPDES discharge requirements are set to meet the state's water quality standards and federal treatment technology standards, with the most restrictive standard applied. NPDES permits are issued by the WRC and, in many cases, require the permittee to make submittals to MDNR for review and approval. These submittals may include plans and specifications for facility construction, an Industrial Pretreatment Program (IPP), programs for effective residuals management, Pollution Incident Prevention Plans (PIPP), a toxic substance monitoring report, waste characterization studies, and others. The facility is required to monitor its discharge and may be required to submit monthly operating reports to the state. The parameters to be monitored and the sampling frequency are specified in the permit. Failure to comply with permit requirements can be handled by a wide range of enforcement options, including administrative, civil or criminal actions.

Air

i) BI-NATIONAL

The 1987 Amendments to the GLWQA added Annex 15, entitled "Airborne Toxic Substances." This Annex instructs the two governments to conduct research, surveillance and monitoring, and to implement control measures to reduce atmospheric deposition of toxic substances to the Great Lakes Basin. The Agreement calls for the development of control measures and technologies to reduce the sources of atmospheric emissions.

ii) CANADA

Under the Canadian Environmental Protection Act, industrial emission standards, regulations and guidelines have been established for five substances: chlorobiphenyls, asbestos, lead, mercury, and vinyl chloride.

iii) ONTARIO

The provincial Air Pollution Control (General) Regulations prescribe the maximum concentration of a contaminant at a point of impingement; these limits apply to all sources.

iv) UNITED STATES

The federal Clean Air Act (CAA) gives authority to the USEPA to approve state programs affecting air quality (40 CFR Parts 51 and 62). This is accomplished by the development of ambient air standards and by control of emissions of specific pollutants from point sources. National Ambient Air Quality Standards (NAAQS) are developed by the USEPA for six pollutants: sulfur dioxide, photochemical oxidants, carbon monoxide, nitrogen dioxide, lead, and particulate matter, and will be discussed under non-point controls.

Certain pollutants which have been determined to be harmful to human health are designated as "hazardous" by regulations under the CAA. Control of these hazardous air pollutants, as well as those with NAAQS, is obtained by regulating their emission from point sources. The basic point source emission standard developed under the CAA is the National Emission Standard for Hazardous Air Pollutants (NESHAP) (40 CFR Part 61). NESHAPs exist for eight pollutants (arsenic, asbestos, benzene, beryllium, mercury, radionuclides, vinyl chloride and, although yet to be finalized, coke oven emissions), and are applied to different industrial categories (e.g., polyvinyl chloride plants). For certain classes of new industrial sources, New Source Performance Standards (NSPS), based upon best demonstrated technology, also apply. In addition to pollutants which have NAAQS, NSPSs also exist for fluorides, sulfuric acid mist, hydrogen sulfide and total reduced sulfur compounds.

In addition to either NESHAPs or NSPSs, industrial sources may also need to obtain other emission permits. Two of these are Prevention of Significant Deterioration (PSD) and Non-attainment Area permits. PSD permits are required of major new sources or modifications located in areas which have attained air quality standards. Its purpose is to prevent significant deterioration of the air quality from a pre-determined reference baseline. As part of a pre-construction review, the facility must perform an air quality analysis to demonstrate that operations will not cause an increase in air concentration above the maximum allowable increment. Currently, PSD increments have been established only for sulfur dioxide and particulate matter.

If the new source or modification is located in an area that has not attained NAAQS, the source needs to acquire a Non-attainment Area permit. Generally, this requires use of the lowest achievable emission rate, which is at least as stringent as the NSPS requirements.

v) MICHIGAN

The federal Clean Air Act Amendments of 1970 authorized states to manage their state air programs, by developing a State Implementation Plan (SIP), to provide for the attainment of federally promulgated air standards. In 1973, Michigan submitted, and subsequently received approval for, their SIP. Through the SIP, Michigan's Air Quality Division has delegation of authority from the USEPA for compliance and enforcement of NESHAPs. Inspection of NESHAP sources are required to be routinely performed. Inspections generally involve review of company records to assure that the work practice standards are being met by the source.

The Michigan Air Pollution Act requires that new sources of air emissions obtain a permit prior to initiating construction. Permits are issued on an equipment or process basis, rather than for a discharge point. There is essentially no sampling conducted during site and initial operation inspections. Permits for significant sources require, at least, a one-time source emission test to be conducted by the applicant during the trial operation phase. Very few permits require air monitoring to be conducted by the applicant for pollutants with significant impact potential.

2. MUNICIPAL POINT SOURCE CONTROL

BI-NATIONAL

The GLWQA requires the governments of Canada and the United States, in cooperation with state and provincial governments, to develop and implement programs to abate, control and prevent the discharge of municipal wastes into waters of the Great Lakes system. The phosphorus load reductions outlined in Annex 3 of the GLWQA are to be achieved by controls on phosphorus discharged by municipal waste treatment facilities and the implementation of other programs and measures, such as detergent phosphorus limitations and non-point source programs and measures. All municipal facilities discharging more than one million gallons per day must not exceed a maximum total phosphorus concentration of 1 mg/l in their effluent if discharging into the lake basins.

CANADA

The Canada Water Act Phosphorus Concentration Control Regulations limit the maximum concentration of phosphorus in laundry detergent to 0.5% by weight expressed as phosphorus pentoxide, or 2.2% by weight expressed as elemental phosphorus.

ONTARIO

Municipal waste treatment facility requirements are implemented by the provincial government as outlined in Policy 08-01, "Levels of Treatment of Municipal and Private Sewage Treatment Works Discharging to Surface Waters", and Policy 08-04, "Provision and Operation of Phosphorus Removal Facilities at Municipal, Institutional and Private Sewage Treatment Works." The limits are summarized in Table 7.

Certificates of Approval (C of A) are also issued to municipal Water Pollution Control Plants (WPCPs). As with industrial C of A's, these usually only describe control equipment modifications or specifications; however, some C of A's do contain effluent limits.

The provincial EPA Sewage System Regulations set standards for the construction and operation of sewage systems and the licensing of related businesses. Municipal storm sewer-use by-law control parameters and limits specify the concentration of various parameters, mainly conventional pollutants and metals. Municipal sanitary sewer-use by-law control parameters are similar in scope and degree of control, and apply to all industrial dischargers to the municipal facility. Additional pretreatment requirements, such as technology-based pretreatment, are not specified. However, these by-laws contain a clause enabling the municipality to require oil interceptors, flow monitors, manholes and treatment, as necessary, to meet the by-law limits (without dilution).

UNITED STATES

The Municipal and Industrial Permit Program of the NPDES program regulates point source discharges of municipal waste water (40 CFR Parts 122-129). Effluent limitations on municipal waste water are required of Publicly Owned Treatment Works (POTWs) to regulate the amount of pollutants discharged into the receiving stream. The regulations generally address conventional pollutants, such as biological oxygen demand, total suspended solids and pH.

MICHIGAN

The same procedural requirements that apply to industrial sources for permit issuance and regulation of pollutants also apply to municipal facilities in the State of Michigan. The facilities are required to have discharge permits issued under the NPDES program to assure compliance with the state's water quality standards and treatment technology established by the federal government.

An important component of the municipal regulation program is the Industrial Pretreatment Program (IPP). In Michigan, approximately 116 POTWs have been required to develop and implement IPPs. The primary emphasis of the state program is to ensure that POTWs develop and enforce their pretreatment programs in accordance with federal and state requirements, to ensure that industrial contributors comply with industry-specific USEPA pretreatment requirements. These pretreatment requirements are established to ensure that discharge from industrial facilities does not interfere with the operation and sludge disposal of municipal treatment facility, cause municipal NPDES permit violations, cause pollutants to pass through the facility, or cause acute and/or chronic toxicity effects on the receiving stream. Regulated pollutants may include: 1) pollutants limited by federal categorical standards and dischargers from categorical sources (these are defined as federal regulations promulgated by USEPA); 2) pollutants for which there are discharge limitations in NPDES permits for the POTW (these are established by action of the Michigan Water Resources Commission); 3) pollutants for which concentration limits are established in the PERM in order to allow safe sludge disposal (the PERM, Program for Effective Residual Management, is proposed by the POTW and approved by MDNR); 4) pollutants which must be controlled in order to avoid operational problems in the POTW or its sewer system (this includes the federal prohibited discharge criteria and other requirements established by the federal government).

POTWs are the central force in assuring that industrial dischargers within their service area comply with their mandated responsibilities. The state plays an active role in overseeing administration of the POTW programs. This is normally accomplished through auditing and an advisory role. However, when necessary, the state stands ready to enforce pretreatment program requirements against both POTWs and industrial dischargers.

In addition to legislation alluded to above, Michigan Act 98, as amended, provides for the classification, specification, certification and supervision or municipal waste treatment systems by the state health commissioner, as well as providing penalties for violations.

E. NON-POINT SOURCE CONTROL

1. SPILLS AND SHIPPING

BI-NATIONAL

The GLWQA, in Article VI, Annex 5 and Annex 6, contains several provisions for control of pollutants resulting from shipping activities. Specific programs and measures for the prevention of oil and hazardous substance discharges include regulations for the design, construction and operation of vessels to ensure that adequate means of containing on-board or transfer spills are available, and ensuring that vessel personnel are adequately trained to handle such substances. Methods of identifying and monitoring vessels carrying hazardous substances are also required of programs developed under this Agreement. The GLWQA also requires the development of measures for the control of discharges of vessel wastes (garbage, sewage and waste water).

Annex 9 of the GLWQA describes the Joint Contingency Plan, the purpose of which is to provide for a coordinated and integrated response to pollution incidents in the Great Lakes System by responsible federal, state, provincial and local agencies. The objectives of the plan include the development of appropriate preparedness measures and effective systems for discovery and reporting of pollution incidents, measures to restrict the spread of the pollutant and provision of adequate cleanup response.

In April of 1988, a Memorandum of Understanding (MOU) on Cooperation was signed by the Premier of Ontario and the Governor of Michigan, proclaiming agreements between the two governments on various environmental issues. Included in this MOU was the recognition by the state and the province that the Great Lakes constitutes a shared resource. The Ontario-Michigan Letter of Intent on Notification and Consultation Procedures for Unanticipated or Accidental Discharges of Pollutants into Shared Waters of the Great Lakes and Interconnecting Channels was signed, describing steps and actions to be taken in the event of a pollutant spill.

CANADA

The Canada Shipping Act controls pollution from ships. Regulations have been passed under this legislation directed at shipping activities that may impact water quality, including the control of the discharge of oil, vessel wastes and shipboard wastes. Under these regulations, the vessel may be fitted with a package sewage treatment plant, which treats sewage to secondary standards, and reduces both suspended solids and the five day biological oxygen demand to 50 mg/l. The alternative requires the

vessel to be fitted with a holding tank which must be emptied on shore. In both cases, a 90 percent reduction occurs, and the remaining treated effluent is disinfected.

The protection of the environment and human health from chemical spills during transportation or storage is regulated by both the provincial and federal governments. The Transportation of Dangerous Goods Act (TDGA) prescribes safety requirements, standards and safety marks on all means of transport across Canada.

ONTARIO

Pleasure craft are controlled by Ontario's Boating and Marine Regulations, pursuant to the Environmental Protection Act. Small boats must be fitted with holding tanks to contain waste water, which are emptied by special pumps at marinas. Non-waste water is not regulated under provincial regulations.

The provincial Dangerous Goods Act reiterates the measures outlined under the federal TDGA. Provincial Guidelines for Environmental Protection Measures at Chemical Storage Facilities recommend preventive procedures consistent with those of the Manufacturing Chemists Association. For liquids, this would entail diked containment at a location away from piping and drainage systems, the compatibility of liquids stored in close proximity and the use of safety alarms. Gases and volatile liquids should be stored in appropriately vented roof tanks with water deluge systems to capture any escaping soluble compounds. All drainage and leakage from storage areas should be collected and treated prior to disposal.

Part IX of the Environmental Protection Act, referred to as the "Spills Bill", deals with spills of pollutants into the natural environment from or out of a structure, vehicle or other container, that are abnormal in light of all circumstances, and which cause, or are likely to cause, adverse effects. The "Spills Bill" establishes notification requirements, responsibilities and compensation mechanisms, in addition to other factors. The Ontario Spills Action Centre, whose origin was spawned by the "Spills Bill", coordinates the Ministry's response network, working closely with the Canadian Coast Guard, police and fire departments, and other reporting centers.

UNITED STATES

Regulations under the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended in 1986 by the Superfund Amendments and Reauthorization Act (SARA), identify "hazardous" substances, reportable quantities of these substances, and notification requirements in the event of a release (40 CFR Part 302). Notification of a release of a hazardous substance, in quantities equal to or greater than its reportable quantity, occurring in a twenty four hour period, by any person having knowledge of the release, is required. Some exceptions to this requirement exist, such as the legal application of pesticides.

The Solid Waste Disposal Act, which was amended by the Resource Conservation and Recovery Act and the Hazardous and Solid Waste Amendments, requires transporters of hazardous waste to take appropriate immediate action in the event of a discharge, such as a spill, occurring during the transportation of the material (40 CFR Part 263). The regulations require that the transporter clean up, or take other action required by state or local regulations, to ensure that the hazardous waste no longer presents a threat to humans or the environment. The transporter is required to give notice to the National Response Center (NRC) and to report the incident in writing to the Office of Hazardous Materials Transportation Bureau.

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP), developed under CERCLA, is, in part, concerned with the discharge of oil to navigable waters of the U.S (40 CFR Part 300). Once a discharge has been discovered, a report must be made to the NRC. A preliminary assessment is made of the discharge, using available and supplemented data. This assessment evaluates the magnitude and severity of the discharge, and its probable impact on public health or welfare, and the environment. It also assesses the feasibility of removal, identification of any potentially responsible parties, and attempts to have the discharger voluntarily perform removal actions. Actions are then taken to reduce or eliminate the threat to people and the environment resulting from the discharge by undertaking remedial actions. These actions often involve controlling the source of the discharge, containing the contaminated water, and using chemicals to contain the spill. After these countermeasures have been taken, the response is documented and attempts at cost recovery are made.

The Emergency Planning and Community Right To Know Act of 1986, which is Title III of the Superfund Amendments and Reauthorization Act of 1986, requires certain facilities handling hazardous substances to participate in emergency planning procedures and to notify authorities in the event of a release (40 CFR Part 355). The requirement to develop emergency planning procedures, and participate in local emergency planning processes, applies to any facility containing an amount of an "extremely hazardous substance" (as defined in the regulations) greater than its threshold planning quantity (TPQ). The TPQ for each of over 300 substances was developed based upon the chemical, its physical form, reactivity and concentration. If the facility produces, uses or stores a hazardous substance in excess of its TPQ, the facility is required to inform the local emergency planning committee. If the facility releases a reportable quantity of one of the extremely hazardous substances, it is required to immediately notify the community emergency coordinator of any area likely to be affected. Information on the chemical, its hazard, the nature of the release, and any appropriate precautions to be taken must be provided. A follow-up written notice on the release and resultant actions is also required. Several types of releases are not required to be reported under this Act, such as federally permitted releases.

A prohibition on the discharge of oil in harmful quantities into navigable waters of the U.S. is also provided by the Clean Water Act (CWA). Discharged quantities of oil which violate water quality standards, or cause a film, sheen or sludge to form, are prohibited. The use of dispersants on oil spills is also prohibited. The CWA requires owners or operators of facilities which present a threat of an oil discharge to prepare a Spill Prevention Control and Countermeasure (SPCC) plan (40 CFR Part 112). Any facility which has discharged more than 1000 U.S. gallons of oil into U.S. waters in a single spill event, or has discharged harmful quantities of oil on two or more occasions, must report these incidents to the USEPA and the state, upon which the USEPA can amend the SPCC.

The PCB spill cleanup policy is contained in the Toxic Substances Control Act (TSCA) regulations, and establishes criteria to determine the adequacy of the cleanup of a spill of substances containing PCB concentrations greater than 50 ppm (40 CFR 761). The cleanup standards vary with the concentration and mass of PCBs spilled, and the location and nature of the material contaminated (impervious/non-impervious, high/low contact), but are generally either 10 ug/m3 or 100 ug/m3 for solid material and between 10 to 50 ppm for soil.

MICHIGAN

All watercraft in Michigan waters are regulated under the Watercraft Pollution Control Act of 1970 (Act 167). This Act prohibits the activities of littering or polluting the state's waters with sewage, oil or other liquid or solid material. Owners or operators of any watercraft that violate this Act are guilty of a misdemeanor and shall be fined, and are responsible to immediately remove any oil or oily wastes from the waters, shorelines or beaches. This Act also requires all watercraft with a marine toilet to be equipped with an acceptable pollution control device.

Michigan regulations on oil spills and polluting material (Water Resources Commission Act, Part 5, Rules 151 to 169) address requirements for oil loading and unloading, oil storage facilities and emergency containment structures. They also include regulations for salt storage areas and for storage, use, and emergency containment structures for other polluting materials. Oil storage facility owners must submit to the Water Resources Commission a plan for prevention of spills and set forth emergency cleanup procedures and inventory monitoring methods to be used. The rules also authorizes companies to form oil spill cooperatives. Provisions of Michigan's spill control rules are enforced by the Water Resources Commission.

Michigan Act 61, referred to as the Oil and Gas Act, which addresses permitting, drilling, production and abandonment of wells, requires the operation of wells in such a manner to prevent the escape of oil, gas, saltwater, brine, or oil field wastes to prevent pollution, damage or destruction of fresh waters of the state, the Great Lakes and connecting channels.

Michigan DNR operates a Pollution Emergency Alert System (PEAS). A telephone line is maintained on a 24-hour toll-free basis for callers to report suspected pollution incidents. MDNR staff responding to calls and complaints contact appropriate field people to investigate and respond to emergency situations. Depending on the nature of the spill, primary notification is provided to the MDNR Air Quality Division, Environmental Response Division, Surface Water Quality Division, Geological Survey Division, and/or Waste Management Division. In addition, depending on the nature of the spill, the USEPA may be notified as well as the Michigan Departments of Agriculture, Transportation, Public Health, State Police, and/or other divisions within the MDNR. All spills from Michigan to waterways shared with Canada are reported to the Ontario Ministry of the Environment.

2. URBAN RUNOFF

BI-NATIONAL

The Great Lakes Water Quality Agreement (GLWQA), in Article VI, requires, in part, the development of programs to abate, control and prevent pollutants from entering water of the Great Lakes Basin from urban drainage. Urban drainage management control programs were identified, including erosion controls, street cleaning, detention of storm water and runoff, and combined sewer overflow controls, but the application of these programs is left to the discretion of the parties. The 1987 Amendments to the GLWQA, in Annex 13, further delineate programs and measures to be developed. The goals of these programs are to reduce input of phosphorus, sediments, toxic substances and microbial contaminants contained in drainage from urban and rural land. Activities which are contributing to water quality problems are to be identified, and estimates of pollutant loadings to Great Lakes Basin waters resulting from non-point source inputs are to be made.

CANADA

Guidelines for the control of urban runoff are addressed by the provincial government.

ONTARIO

There are no regulations in Ontario specifically addressing storm water runoff. Some control is achieved through comments on official plan amendments and sub-division plan reviews to decrease the impact of suspended solids.

The Ontario MOE, under the Drainage Act has developed draft Guidelines for Urban Drainage Design, Erosion and Sediment Control for Urban Construction Sites. An Urban Drainage Management Program for New Development Sites is proposed, but is not yet finalized. Many of the practices recommended in these guidelines are implemented at the municipal level.

Combined sewers are addressed by the sanitary sewer-use by-laws, as part of the municipal waste treatment facility. During intense storms, combined sewer overflows (CSOs) may bypass all or part of the WPCP. No municipalities have control strategies or measures to prevent this outside of the costly process of separating the combined sewer into storm and sanitary sewers. CSOs are sometimes chlorinated in an attempt to minimize their impact on human health.

Guidelines for Snow Disposal and Deicing Operations in Ontario are intended to minimize surface and/or ground water quality impairment from by the use of salt for winter road maintenance, and improper snow disposal practices.

UNITED STATES

USEPA Region V has developed the NPDES Permit Strategy for Combined Sewer Systems for addressing overflow of combined sewer systems through the NPDES permit process. Authorization for this strategy comes from the Clean Water Act, Section 402, which authorizes the USEPA to take steps to carry out the provisions of the Act.

The purpose of the strategy is to incorporate planning and management procedures into combined sewer system operations, resulting in a more effective management of the system. The strategy has two phases, and is implemented during NPDES permit re-issuance or modification. Phase I of the strategy aims to incorporate best management practices into combined sewer system operations by requiring certain provisions in the permit, such as authorization of all overflow points, maximization of flow volume to the treatment plant during wet weather flows, prohibition on the diversion of a waste stream during dry weather conditions (bypass), and in-system flow monitoring at key hydraulic points.

If the permit provisions required by Phase I of the strategy are not effective in preventing significant water quality problems, Phase II of the strategy is implemented. Additional requirements are incorporated into the dischargers permit, including monitoring of the combined sewer overflow, and if necessary, the receiving stream, to assess impacts, development of a plan to limit inflow, controlling the sources contributing toxic pollutants, and development of a sewer rehabilitation program.

MICHIGAN

Michigan is addressing the problems of combined sewer overflows through its NPDES permitting program. Using guidance provided by USEPA Region V, permittees are being required to perform maintenance on their sewer systems to optimize the carrying capacity and minimize the discharge of combined sewer overflows. As a Phase I activity in the municipalities permits, they will be required to study and evaluate the discharges from their combined sewer overflows. At the conclusion of this Phase I activity, municipalities will be asked to develop plans to move these

dischargers toward compliance with public health and water quality standard concerns.

## 3. AGRICULTURAL RUNOFF

### BI-NATIONAL

The GLWQA identifies agricultural non-point source management programs that may be applied, where feasible, to reduce phosphorus inputs to Great Lakes waters. These include livestock control measures, crop residue management, conservation tillage and cropping, improved fertilizer management practices and other more intensive practices. These non-point controls are discussed in publications of the IJC International Reference Group of Great Lakes Pollution from Land Use Activities (PLUARG), and in "An Overview of Post-PLUARG Developments." Measures regarding pesticides are discussed in a later section.

### CANADA

Agriculture Canada and the Ontario Ministry of Agriculture and Food (OMAF) initiated a five year program to promote soil and water conservation in 1986, called the Soil and Water Environmental Enhancement Program (SWEEP). SWEEP provides technical assistance to farmers through workshops on new technologies and by local demonstrations on tillage and crop rotation. Financial incentives are directed toward controlling erosion from croplands.

### ONTARIO

Ontario's Drainage Act and other environmental acts provide the basis for many programs to manage and improve operations on agricultural lands. OMAF's Soil Conservation and Environmental Protection Assistance Program (OSCEPAP) complements SWEEP. OSCEPAP provides grants for the installation of various soil erosion control devices and manure storage facilities in designated watersheds. The erosion control devices eligible are diversions, fences and ramps to separate water courses from livestock, alternate livestock water supplies, and vegetated buffer strips along water courses. Manure storage tanks, pads, covers and piping for liquid, semi-solid or dry manure systems are also eligible. The Ontario Ministry of Natural Resources is also promoting stream bank erosion controls as part of a program to rehabilitate and enhance fish habitats. Other conservation programs may be carried out by local authorities.

OMAF's Land Stewardship Program provides grants for the adoption of conservation farming practices that will enhance and sustain agricultural production, and improve soil resources and water management by 1) reducing soil erosion and soil compaction, 2) restoring soil organic matter and structure, and 3) minimizing potential for environmental contamination from agricultural practices. The Land Stewardship Program consists of four components: financial assistance, research, education

and extension, and program delivery and service.

OMAF offers a free service to farmers in testing soils, and recommends fertilizer and lime application rates. The Sewage Sludge Implementation Committee advises farmers on the use of sewage sludge and fertilizer. The use of digested sewage sludge is only permitted on pasture, fallow or forage crops and should meet the Ontario Guidelines for Sewage Utilization on Agricultural Land (Table 8). Minimum distances between the disposal site and water sources, times of year for application, and sludge management practices are recommended.

The Agricultural Code of Practice for Ontario (1973), implemented by Ontario MOE and OMAF, promotes the application of all manure to croplands without increasing the potential for water pollution. Minimum acreage requirements for different types of livestock manure are recommended to avoid ground water contamination with nitrogen compounds. Manure handling, storage and spreading requirements are included in the Code. If these cannot be met, alternatives, such as a dry manure system, are considered.

The Farm Pollution Advisory Committee (FPAC) is comprised of four farmers appointed by the Minister of the Environment under Section 3(1) of the Environmental Protection Act. The FPAC's role is to advise the Minister about whether or not, in a specific situation, animal waste is being handled and disposed of in accordance with "normal farming practice", and thereby not impacting quality of nearby water bodies. This advise is crucial to the Minister due to exemptions in the Act for agriculture.

UNITED STATES

In the United States, control of pollution from agricultural land is also based on a management approach. The production of agricultural commodities on highly erodible land or converted wetlands can result in loss of certain funding benefits provided through the U.S. Department of Agriculture (USDA). The purpose of this provision is to remove the incentive for producing on such lands, and thereby reduce soil loss due to erosion, reduce sedimentation, improve water quality and preserve wetlands. Preservation of wetlands is also a joint responsibility of USEPA under Section 404 of the CWA, and the U.S. Army Corps of Engineers.

The Agricultural, Rural Development and Related Agencies Appropriations Act of 1980 authorized the USDA, with assistance from the USEPA, to carry out an experimental Rural Clean Water Program (RCWP). Its purpose is to provide assistance to private landowners in the installation of best management practices (BMP) in areas having critical water quality problems resulting from agricultural activities. Any landowner whose activities are contributing to the area's water quality problems, and who receives approval on their water quality plan, is eligible for the RCWP. The water quality plan must include practices to reduce the amount of pollutants entering local water bodies, such as changing the rate or method of applying potential pollutants.

The Agricultural Conservation Program provides funding for projects which utilize agricultural conservation practices consistent with the Soil Conservation and Domestic Allotment Act. Conservation practices which meet these goals have several aims, including protection against soil erosion, the prevention or abatement of agriculturally-related pollution of water, land or air, and others. States, local governments, private groups or individuals can submit a conservation plan and receive financial assistance for the plan, if approved.

MICHIGAN

In 1985, the Governor directed the MDNR, the MDA and the Michigan Department of Transportation to develop a comprehensive statewide non-point source pollution control strategy. The strategy identified non-point pollution problems in the state, and made recommendations for dealing with the problems. These recommendations were the basis for a new statewide non-point pollution control program known as the Michigan Clean Water Incentives Program (MCWIP). The goal of the MCWIP is to maintain or improve the quality of Michigan's water resources, to maximize designated use support, and meet state water quality standards. The program is designed to provide technical and financial assistance to local units of government for the planning and implementation of watershed non-point source pollution abatement projects.

The federal Clean Water Act amendments of 1987 provided new national impetus to state non-point programs. Section 319 was added, which directed all states to complete two new major efforts in non-point source management by August 1988. The first of these is completion of a statewide assessment or inventory of waters impacted by non-point sources. Information to be addressed in this includes 1) identification of surface and ground water requiring non-point controls to attain or maintain uses or standards, 2) identification of sources which contribute significant loadings to these waters, 3) description of the process for identifying best management practices (BMPs) to control each source or categories of sources, and 4) identification and description of federal, state and local programs for control of non-point sources. The second effort is the development of a state non-point source management program to address non-point problems in impacted waters.

The development of the Michigan Non-point Source Management Program is being coordinated by the Surface Water Quality Division of the MDNR. Since strategies to be employed involve statewide activities at all levels of government and private enterprise, a Non-point Source Advisory Committee has been established. The committee is charged with development of overall policy and activity direction development. Committee membership includes representation from multiple agencies, including local, state and federal agencies. Nine technical committees have also been established to assist the MDNR in developing the program. The strategy and assessment were due to be submitted to USEPA for approval by August 1988.

Michigan Phosphorus Reduction Strategy for the Michigan portion of Lake Erie and Saginaw Bay was completed in August 1985 through interagency efforts of the MDNR, Michigan Department of Agriculture (MDA), USDA Soil Conservation Service, USDA Agricultural Stabilization and Conservation Service, and Michigan State University. The strategy focuses upon point and non-point phosphorus reductions achieved since 1982, and future reductions attainable through implementation of point and non-point source control programs through 1990. The strategy seeks non-point source phosphorus reductions primarily through the implementation of agricultural programs for crop residue management, fertilizer management, and control of animal wastes. Michigan's Guidance for Land Application of Wastewaste Sludge is shown on Table 8. In order to maximize phosphorus reduction within the drainage basins, priority counties were identified for accelerated fertilizer and residue management programs. The Michigan Energy Conservation Program (MECP) was developed to provide energy saving techniques and management practices to Michigan farmers and foresters to help reduce their energy costs. The MECP is designed to provide farmers and forest product producers with direct one-to-one assistance in the following program areas: conservation tillage, irrigation, management and scheduling, fertilizer management, integrated pest management, livestock facility management, and forest management and wood energy. These programs will provide substantial secondary benefits for non-point pollution control efforts in Michigan, as well.

## 4. PESTICIDES

### BI-NATIONAL

The GLWQA, in Article VI, calls for measures to control pesticides (which includes insecticides, herbicides, fungicides, rodenticides, etc.) used in the Great Lakes Basin to ensure that they are used in the correct, legal manner. The Agreement also calls for an inventory of pest control products used in the Basin, and the strengthening of research and education to facilitate integration of pest control techniques. The Agreement has developed specific objectives for several pesticides.

### CANADA

The principal statute controlling pesticides in Canada is the Pest Control Products Act (PCPA). Administered by Agriculture Canada, the PCPA sets out regulations regarding the registration, safety and manufacturing of control products (except 2,4-D) to protect human health and the host plant, animal or article. The Guidelines for Registering Pesticides and other Control Products under the PCPA in Canada provides additional information on registration and labelling requirements, such as warning symbols and content description. Under the PCPA, the Minister of Agriculture Canada can establish independent Boards of Inquiry to advise him on whether pest control products should be registered. For example, in the recent case of alachlor, a Board of Inquiry was established and then disbanded after making their recommendation to the Minister.

Non-regulatory programs at the federal level include a pest management scheme that may reduce reliance on pesticides. The principal approach to reducing reliance on chemical pest control is known as Integrated Pest Management, and is currently being researched by Agriculture Canada.

ONTARIO

The provincial Pesticides Act (1980) prohibits, in general, the discharge or emission of pesticides that would cause or be likely to cause damage to the environment, animal or plant life, or human health greater than the impairment that would necessarily result from the proper use of the pesticide. A license to carry out exterminations and other requirements such as application methods, permits, safety precautions, and use restrictions for specific pesticides are outlined in the Pesticides (General) Regulations.

The only agricultural pesticide program is the Integrated Pest Management Program, administered by OMAF, which provides advice on pesticide use to farmers, but is not directed at environmental or water quality protection.

UNITED STATES

The Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), as amended in 1978, mandates the USEPA to regulate the manufacture, distribution and use of approximately 50,000 pesticide products and devices in the United States (40 CFR Parts 152 to 173). The USEPA carries out this responsibility by requiring all pesticides to be registered with the USEPA, based on data adequate to demonstrate that the pesticide's use will not pose an unreasonable risk to humans or the environment. When a product is registered, explicit directions for the legal use of the product are part of the required labeling and include information on the method, rate and site of application, directions for storage and disposal, and restrictions on use. Any use deviating from the labeled one is considered an unlawful use of the product.

The regulations provide standards for the certification of commercial and private applicators of restricted use pesticides to ensure that these pesticides are handled and used in a safe manner. For commercial and professional applicators, methods of storage and disposal of excess pesticide products and pesticide containers are also recommended under FIFRA. However, RCRA regulates the treatment, storage and disposal of some pesticides.

Prior to a pesticide becoming registered for use on a food or feed crop, a specific allowable residue of that pesticide (a tolerance), or exemption from a tolerance, must be established. Tolerances are set under the authority of the Federal Food, Drug and Cosmetic Act (FFDCA). USEPA establishes tolerances for pesticides, while the FDA and the USDA carry out tolerance enforcement.

MICHIGAN

Information on Michigan's pesticide programs was not provided for this report, but some aspects are briefly discussed in the Non-point Source - Agricultural section.

5. ATMOSPHERIC

BI-NATIONAL

Research and data gathering of air deposition to water bodies is being performed in support of the GLWQA. The 1987 amendments to the GLWQA added Annex 15, entitled "Airborne Toxic Substances", which calls for research, surveillance and monitoring, and implementation of control measures to reduce the atmospheric deposition of toxic substances, particularly persistent ones, to the Great Lakes Basin ecosystem. Research aims to understand the processes of deposition and vapor exchange and the effects of these processes on the health of humans and aquatic organisms, and aims to develop models describing the movement and transformation of toxic substances entering the Great Lakes Basin ecosystem through airborne routes. Monitoring airborne toxic substances throughout the basin is performed by the Integrated Atmospheric Deposition Network. Annex 15 also requires that measures to control emission sources which significantly contribute to pollution of the Great Lakes system be studied, developed and implemented.

The Memorandum of Understanding between Ontario and Michigan, recently signed, contains the Ontario-Michigan Joint Notification Plan for Unanticipated or Accidental Discharges of Airborne Pollutants, outlining steps and actions to be taken by both governments in the event of such an incidence.

CANADA

National Ambient Air Quality Objectives have been established as a guide in developing programs to reduce the damaging effects of air pollution. These national objectives assist in establishing priorities for reducing contaminant levels and the extent of pollution control needed, provide a uniform yardstick for assessing air quality in all parts of Canada, and indicate the need for and extent of monitoring programs. The Maximum Acceptable Level is intended to provide adequate protection against effects on soil, water, vegetation, materials, animals, visibility, personal comfort and well-being. The Maximum Desirable Level defines the long-term goal for air quality and provides a basis for an anti-degradation policy in unpolluted areas of the country. The Maximum Tolerable Level denotes concentrations of air contaminants that require abatement without delay to avoid adverse impacts on human health or aesthetics. The Desirable, Acceptable and Tolerable levels of the contaminants for the different averaging times are presented in Table 9.

An annual air quality index reduces ambient air monitoring data for numerous air contaminants to a single number which describes overall air

quality. The National Ambient Air Quality Objectives are used to provide a common scale with which to quantify the effects of different pollutants on the quality of air. The index is derived from data on sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone and total suspended particle from Class I monitoring stations, and is based on the average of three different pollutant sub-indices that have the most significant effect on air quality.

The Canadian Environmental Protection Act (CEPA), in addition to regulating point source air emissions, also has the authority to regulate fuel and fuel components, which may contribute to ambient air pollution and atmospheric deposition.

A regulation exists under the Environmental Contaminants Act which prohibits the use of fully halogenated chlorofluorocarbons (CFCs) as a propellant constituent in hairsprays and deodorants manufactured in or imported into Canada. The intention of this regulation is to eliminate non-essential uses of CFCs.

ONTARIO

Provincial Ambient Air Quality Criteria, developed under the provincial Environmental Protection Act are also shown in Table 9. Under the EPA, the Ministry may prepare an air pollution index to express the relative levels of air pollution, as discussed above. This index is used to identify air pollution episodes (such as Air Advisory Levels and Air Pollution Alerts), which may result in action on the part of the Minister.

Ontario MOE, in conjunction with the Michigan DNR, the Lambton Industrial Society, and representatives from Wayne County, Michigan, prepare a yearly summary of transboundary air contaminant movement. Monitoring is most extensive for ozone, sulfur dioxide, carbon monoxide, total suspended particles and particle-bound lead. Less extensive monitoring is conducted for oxides of nitrogen, hydrocarbons, reduced sulfur and other constituents of the particulate matter. Ontario MOE also conducts ambient air quality monitoring in Sarnia, Windsor and Sault Ste. Marie, measuring similar parameters as above, and issues an annual report.

The Ontario MOE Air Resources Branch conducts studies of long range transportation and deposition to the Great Lakes, specifically for toxic contaminants. There are two permanent air monitoring stations involved in this study; one near Lake Huron and one near Lake Erie. Ontario MOE, with Environment Canada, is also monitoring the effect of the City of Detroit incinerators on air quality, with air monitoring stations in Windsor. Ontario MOE also has air monitoring stations in Amherstberg and Windsor, measuring radioactivity in particulate matter originating from a nearby accelerator laboratory.

The LIMA (Lambton Industrial Meteorological Alert) Regulation (Ontario Regulation 151/81) focuses on the effect of Sarnia industries on air quality. If levels of sulfur dioxide in the Sarnia area exceed 0.7 ppm,

the Regional Director of MOE can declare an alert, and order designated industries to reduce emissions, and operations, if necessary. Four monitoring stations area involved in this: two in Sarnia, one in Corunna and one in Port Huron, Michigan.

UNITED STATES

The Clean Air Act (CAA) gives authority to the USEPA to approve programs addressing air quality, accomplished by the development of ambient air standards and control of emissions of specific pollutants from point sources. Point source controls were discussed in previous sections; ambient and non-point source controls are discussed here.

National Ambient Air Quality Standards (NAAQS) consist of both primary and secondary numerical standards (40 CFR Part 50). Primary ambient air standards are those levels necessary to protect public health, and are health-based; secondary standards are to protect public welfare (e.g., building materials, aesthetics). NAAQS exist for six pollutants: sulfur dioxide, carbon monoxide, ozone, nitrogen dioxide, lead and particulate matter with an aerodynamic diameter of ten microns or less (PM-10), and are presented on Table 9.

The CAA provides the USEPA with authority to control and/or prohibit fuels and fuel additives used in motor vehicles which have been determined to endanger public health (40 CFR Parts 79-80). To this end, the EPA requires registration of fuel and fuel additives. Gasoline cannot be produced or imported for sale in the U.S. if it contains an average lead concentration of greater than 0.1 g lead/gallon of fuel. The CAA regulations stipulate emission requirements for new motor vehicles as a method of controlling air quality (40 CFR Parts 85-86). The emission requirements vary with the weight of the vehicle (light- or heavy-duty), the type of vehicle (car, truck, motorcycle), the type of fuel used (gasoline or diesel), the type of emission (exhaust or evaporative), and the year and, sometimes, weight of the vehicle. Testing procedures and equipment required to perform gaseous, particulate and evaporative emission tests on vehicles are established in the regulations.

MICHIGAN

The State of Michigan manages its own air program, as described in its State Implementation Plan (SIP). The NAAQS are the established federal standards to which Michigan SIPs adhere. Michigan's Air Pollution Control Commission may establish standards for ambient air quality via the rule-making process, although this process has not been used in the past. Ambient air monitoring is conducted in Michigan in some industrial areas known or suspected to have significant releases of toxic air pollutants. Sampling is conducted in both source-specific and receptor-specific modes. Results are used for general assessments of local air masses and as evidence for enforcement actions. Monitoring is conducted for lead at thirty-two sites state-wide pursuant to the federal ambient air monitoring network. Currently no organized monitoring program exists

for organic pollutants on a state-wide or regional basis; however, some source-specific organic pollutant monitoring is performed.

The Michigan Motor Vehicle Act (Act 83_ and its associates rules outline auto emission and testing standards,in an effort to reduce air impacts from motor vehicles.

The state is required to report to the public on a daily basis an air quality index (40 CFR Part 58, App.G). This index is a modified form of the Pollution Standards Index, and is based on the ambient concentration of five pollutants having NAAQS: sulfur dioxide, carbon monoxide, ozone, nitrogen dioxide, and PM10. Air quality descriptors, "good", "moderate", "unhealthful", "very unhealthful" and "hazardous" are given to index ranges which are based on the sub-index of each pollutant.

## 6. INPLACE POLLUTANTS

### BI-NATIONAL

Article VI and Annex 7 of the GLWQA, as amended, provide for the development of a Subcommittee on Dredging to review the existing practices in the United States and Canada relating to dredging activities, and to develop guidelines and criteria for dredging activities in boundary waters of the Great Lakes System. Annex 14 of the GLWQA, as amended, calls for the parties to develop a standard approach and agreed upon procedures for the management of contaminated sediments by December 31, 1988. The IJC Sediment Subcommittee has completed (draft) guidance documents on the evaluation of contaminated sediment problems and available remedial technologies. Guidelines for Evaluation of Great Lakes Dredging Projects, developed by the Dredging Subcommittee of the Great Lakes Water Quality Board are shown in Table 10. These guidelines are average concentrations of contaminants in surficial sediments for Lakes Huron and Erie. Sediment contaminant concentrations exceeding these guidelines are considered degraded and should not be disposed of in the open lake.

### CANADA

Federal authority over contaminated sediments in the Great Lakes Basin is limited; the province of Ontario is primarily responsible. However, under the Canada-Ontario Agreement (COA), a Polluted Sediment Subcommittee has been formed with membership from Environment Canada and Ontario MOE. This subcommittee has been charged with 1) developing a standardized assessment procedure for assessing contaminated sediments, and 2) evaluating options for the management of contaminated sediments.

### ONTARIO

Ontario MOE's revised Guidelines for Dredged Spoils for Open Water Disposal (1978) are designed to protect the aquatic environment from pollutants that may be released from the disposal of sediments. The

Guidelines are also used to assess the level of contamination of inplace pollutants, in the absence of other objectives. Under the Environmental Protection Act, the Minister of Environment can order the removal of contaminated sediments. The Ontario MOE Guidelines are contained in Table 10.

UNITED STATES

The Clean Water Act (CWA), in Section 115, authorizes funds to identify areas containing toxic in-place pollutants, and to develop plans for sediment removal and disposal from critical ports and harbor areas. The 1987 amendments to the CWA authorize further studies and demonstration projects to be carried out in the Great Lakes.

Section 404(b) of the CWA empowers the U.S. Army Corps of Engineers to issue permits to govern dredging and fill operations which alter the bottom elevation of a water body for the purposes of navigation, or replacing an aquatic area. It is not intended to regulate the discharge of pollutants into waters for the purposes of disposal. Control over the discharge of dredged and fill material at specific disposal sites is maintained through a permitting process. The USEPA can prohibit the designation or use of an area as a disposal site if it has determined that the discharge would have an unacceptable adverse effect on municipal water supplies, fisheries, wildlife, or recreational areas. A factual determination is made in each instance, and considers the impact of the disposal on the physical and chemical characteristics of the receiving stream, and effects on structure and functioning of the aquatic ecosystem. Several types of dredge or fill material discharges are not considered, such as that resulting from normal farming activities or maintenance of serviceable structures (e.g., levees).

In some instances, contaminated sediments may be regulated under RCRA, such as in the instance when dredged sediments exhibit one or more of the hazardous waste characteristics defined under RCRA, or if a release occurred at a treatment, storage and disposal facility, as defined under RCRA.

The USEPA Region V has developed Guidelines for The Pollutional Classification of Great Lakes Harbor Sediments, contained in Table 10. USEPA is currently in the process of developing sediment criteria.

MICHIGAN

Regulations or guidelines dealing with sediment assessments are applied only when the sediments are to be dredged. Dredging projects in Michigan are evaluated following the guidelines presented in Chapter 5 of "Guidelines and Register for Evaluation of Great Lakes Dredging Projects," Report of the Dredging Subcommittee to the Great Lakes Water Quality Board, January 1982, and the USEPA Guidelines for the Pollutional Classification of Great Lakes Harbor Sediments 1977. All dredging projects proposed in Michigan are subject to review and certification under Section 401(a) and 404(t) of the federal Clean Water Act (P.L. 92-

500). Dredging permits and 401 certification may also be required under Michigan's Inland Lakes and Streams Act (Act 346) and the Great Lakes Submerged Lands Act (Act 247).

In Michigan, there is no procedure or one set of criteria that is used to determine whether sediments are "contaminated" when not associated with dredging activity. Historically, however, USEPA Guidelines for Pollutional Classification of Great Lakes Harbor Sediments have frequently been used to determine the degree of contamination. Recently, however, Michigan has begun to take a new approach to evaluating sediments that considers biological effects of contaminants associated with sediments. This new approach is in the developmental stages, and evaluation of sediments in Michigan continues to be a reactive (rather than proactive) process initiated by either a proposal for dredging or investigation of a suspected problem.

## F. SOLID AND HAZARDOUS WASTE CONTROL REGULATIONS

### BI-NATIONAL

The GLWQA, in Annex 13, calls for the development of programs to abate and reduce pollution from land-use activities, including waste disposal sites. At the present time, no specific guidelines are developed by the GLWQA for siting or management of solid or hazardous waste sites.

### CANADA

The federal Environmental Contaminants Act (ECA) provides the power to compel disclosure of information about chemicals in commercial use, and to undertake investigations to determine their fate in commerce and the environment. The ECA restricts the handling and disposal of selected substances; however, the province controls the use of such substances. The recently passed Canadian Environmental Protection Act (CEPA) provides control over the manufacture, transportation, use, disposal, importation and exportation of chemicals and wastes where not adequately controlled by regulation in other legislation.

There are three regulations under the ECA addressing polychlorinated biphenyls (PCBs). These regulations restrict the use of PCBs, the import, manufacture and sale of products containing PCBs and the release of PCBs to the environment. Three other regulations under the ECA prohibit all commercial, manufacturing and processing uses of mirex, polychlorinated terphenyls and polybrominated biphenyls.

The Federal Guidelines for the Management of Wastes Containing Polychlorinated Biphenyls (1987) deal with the removal from service and disposal of PCB equipment, solids and liquids containing 50 ppm or more of PCBs. The guidelines outline labelling, decontamination, storage and disposal requirements, and are intended to complement other federal and provincial regulations regarding PCBs.

ONTARIO

Solid and hazardous waste programs are implemented by the provincial government mainly under the Environmental Protection Act (EPA). The EPA Waste Management-General Regulations describe the classification and approval of waste disposal sites and waste management systems. Standards for the location, maintenance and operation of a landfill site are outlined, including measures to be taken for the collection and treatment of contaminants for the prevention of water pollution. These include locating the landfill site above, or isolated from, the maximum ground water level and allowing sufficient distance from water sources unless all leachate is collected and treated. The Waste Management General Regulations and related policies are summarized in a document called "The Incorporation of the Reasonable Use Concept into the Ground Water Management Activities of the Ministry of the Environment."

In addition to landfill record-keeping requirements, an expanded manifest system was recently implemented under EPA Regulation 309 to ensure the registration of wastes by generators, and proper handling, shipping and disposal by carriers and receivers.

The Hauled Liquid Industrial Waste Disposal Sites Regulations prescribes standards for the operation and maintenance of all Ministry-approved industrial sites. One requirement is that ground water and surface water quality in and around the site shall be regularly monitored.

The Guidelines for the Treatment and Disposal of Liquid Industrial Wastes in Ontario also applies to Ministry-approved waste treatment and disposal processes or sites (except those covered by other regulations or guidelines). These Guidelines list various industrial wastes and recommend a corresponding treatment and disposal process.

The provincial Waste Management PCB Regulations require owners or generators of PCB wastes to keep records regarding the waste's nature, quantity, storage method and location on-site (or transportation off-site), while awaiting final resolution of the waste.

Standards for the location, maintenance and operation of mobile PCB destruction facility waste disposal sites are included in the Mobile PCB Destruction Facilities Regulations. Two such companies operate in Ontario. Maximum point of impingement levels are imposed on air emissions of PCBs, chlorinated dibenzodioxins, and chlorinated dibenzofurans. All solid wastes generated must be disposed of at a certified waste disposal site.

Ontario Regulation 303, under EPA, prohibits disposal of any liquid industrial waste into the Detroit River Group geological formation. It also prohibits the disposal of brines into the Detroit River Group within eight kilometers (5 miles) of the St. Clair River. Oil field brine is exempt from this regulation. All brine disposal wells into the Detroit River Group greater than 8 kilometers from the St. Clair River are gravity-feed only. These prohibitions came into effect in 1974.

UNITED STATES

Management of solid and hazardous waste is regulated, in part, by the Solid Waste Disposal Act (SWDA). The 1976 amendments to the SWDA, best known as by the Resource Conservation and Recovery Act (RCRA), resulted in many of the familiar aspects of present-day RCRA programs when those regulations were finally promulgated in 1980. In 1984, significant changes in the SWDA became law, and are known as the Hazardous and Solid Waste Amendments (HSWA). Subtitles C, D and I of the SWDA regulations describe the three distinct programs, commonly referred to as RCRA programs. These are the Solid Waste Program (Subtitle D), the Hazardous Waste Program (Subtitle C), and the Underground Storage Tank Program (Subtitle I).

The primary goal of the Solid Waste Program is to encourage solid waste management practices that promote environmentally sound disposal methods, maximize re-use of recoverable resources and foster resource conservation. Two different facets of the Solid Waste Program are developed: the technical standards for facilities, referred to as Subtitle D Criteria (40 CFR Part 257), and a voluntary state solid waste management program (40 CFR Parts 256).

Features which define a Solid Waste Facility are established in the Subtitle D Criteria. These criteria are used to identify inappropriately managed facilities which must be either upgraded or closed. The HSWA of 1984 required re-evaluation of the Subtitle D Criteria to determine their adequacy, and to address hazardous household wastes and small quantity generators of hazardous waste. Regulations for small quantity generators (SQG) became effective in 1986. Results of other studies are expected to be available in 1988. Several waste disposal practices are exempt from the Solid Waste Program, such as land application of domestic sludge.

The Hazardous Waste Program is designed to ensure the safe and effective management of hazardous waste (40 CFR Parts 260-272). Waste is defined as hazardous if it exhibits any of certain specific chemical or physical characteristics, is listed as such, or is identified as such by its generator. According to the "mixture rule", a mixture containing a hazardous waste is also a hazardous waste. As part of the Hazardous Waste Program requirements, a paperwork manifest system, tracking the physical movement of the hazardous waste, is utilized. This Uniform Hazardous Waste Manifest system provides specific information on the quantity and nature of the waste and the parties involved in the production, transportation and disposal. Copies of the manifest are retained at each step of the transportation chain, and copies are kept on record for specified times.

Specific requirements exist for generators, transporters and owners or operators of treatment, storage and disposal (TSD) facilities. All facilities must, at a minimum, possess a USEPA identification number. Requirements for generators include the proper labeling, packaging and limited accumulation of the waste, adequate training of personnel, and

the development of contingency plans and emergency procedures. Transporters must be trained to adequately respond to discharges, such as spills. Requirements for TSD owners or operators are more complex, and differ if the facility is operating under an interim status (permit by rule), or is a fully permitted facility. Interim status facility regulations are more general, and relate more to "good housekeeping practices", whereas permitted facility requirements specify design and operating criteria specific for the facility.

The Underground Storage Tank (UST) program is concerned with tanks having 10% or more of their volume underground, containing petroleum products or hazardous substances (40 CFR Part 280). Some types of tanks, such as septic tanks, are exempt. The UST program has five parts: a ban on unprotected new USTs (i.e., USTs, without cathodic protection to protect against corrosion), notification to authorities of existing USTs, development of performance standards, state management of the program and inspection and enforcement authority by states and the federal government. For underground storage tanks to be permitted, it must be shown that the tank is designed to prevent release due to corrosion or structural failure, and that the construction of the tank is compatible with the stored waste.

The Toxic Substances Control Act (TSCA) provides the USEPA with broad authority over the manufacturing, importing and processing of a broad range of chemical substances, about 63,000 in number, intended for commercial purposes (40 CFR Parts 702-799). This is accomplished by regulating the use of chemicals through reporting and notification requirements. Reporting of information on production, use, health and safety studies and other factors for chemical substances on the TSCA Inventory is required of manufacturers, importers and processors, with certain exceptions.

New chemical substances, not on the Inventory, are also regulated under TSCA. Manufacturers of new chemical substances are required to submit a Premanufacturer Notification (PMN) prior to the manufacture of the chemical, supplying information on the properties of the new substance, its intended use, the method and extent of manufacture, description of by-products, and other data. TSCA also identifies "significant new uses" of chemical substances currently on the Inventory. Submittal of a notice is required prior to use, describing the chemical and its ultimate use, and any research and development data available.

The use, manufacture, processing and distribution of PCBs and PCB items are effectively banned by TSCA, with certain exceptions (40 CFR Part 761). Specific requirements are developed for the labeling of PCB-containing items, such as transformers and capacitors. Specific methods for long term storage of PCBs and PCB items are required, and stipulate that, to comply, a facility must be endowed with certain characteristics, such as adequate protection against floods and rain. Disposal requirements stipulate use of either an incinerator or a chemical waste landfill, both of which need to comply with certain criteria. Record-keeping and reporting requirements for PCBs and PCB items, and PCB

storage and disposal facilities, (including incineration facilities) are also described in the regulations.

Regulations developed under TSCA require manufacturers and processors of certain chemical substances to analyze these chemicals for the presence of halogenated dibenzodioxins and dibenzofurans (HDDs/HDFs), and to submit the results of these tests, and any health and safety studies, to the USEPA (40 CFR Part 766). If testing confirms the presence of HDDs/HDFs above the prescribed level of quantitation, additional information is required on production, process, exposure and disposal.

TSCA requires the submittal of information on the quantity and use of, and exposure to, asbestos by users (40 CFR Part 763). In 1986, USEPA proposed a phased-in ban on the import and use of asbestos. TSCA requires local education agencies to identify friable asbestos-containing material in schools. Information on the health effects, and methods of avoiding or reducing exposure to asbestos, must be provided to employees and parent-teacher organizations. Asbestos abatement programs undertaken by governmental employees not covered by the asbestos standards of the Occupational Safety and Health Administration (OSHA) must comply with certain requirements developed in the regulations under TSCA.

The manufacture, processing and distribution of fully halogenated chlorofluorocarbons (CFCs), for use as an aerosol propellant, is prohibited under TSCA (40 CFR Part 762). Other uses of CFCs, such as in drugs or cosmetics, are regulated by the Food and Drug Administration. Recordkeeping and report requirements for manufacturers of CFCs for use as an aerosol propellant are contained in the regulations as well.

Good Laboratory Practice (GLP) standards are prescribed in the regulations under TSCA, and apply to studies of health and environmental effects and chemical fate testing (40 CFR Part 792). GLP standards are intended to ensure that data are of good quality and integrity. Guidelines for the testing of chemical substances regulated under TSCA provide specific methods and approaches to be used for reporting requirements. Guidelines are developed for chemical fate, and environmental and human health effects.

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) was developed out of the dual authority of CERCLA and the CWA. The NCP is concerned with discharges of oil into navigable waters of the United States and adjoining shorelines, and with releases of hazardous substances or pollutants into the environment (40 CFR Part 300). The plan provides a means of response to discharges, and outlines the division of responsibility in such a response. The portion of the NCP relating to oil discharges was discussed in a previous section.

CERCLA, which is colloquially referred to as "Superfund", was amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), which contained two additional Acts: The Emergency Planning and Community Right To Know Act of 1986 (Title III) and the Radon Gas and Indoor Air Quality Research Act of 1986 (Title IV). Regulations under CERCLA identify an

extensive list of substances which have been designated as hazardous (40 CFR Part 302). These regulations also identify reportable quantities and notification requirements for these substances in the event of a release. In the event of an actual or potential release of a hazardous substance, CERCLA authorizes removal or remedial action to be taken. A Preliminary Assessment is made of the site, and determines the nature and source of the release, the magnitude of the threat presented by the release, whether an emergency removal or longer term remedial response is indicated, and whether responsible parties are responding in an adequate fashion.

The decision to perform an emergency removal is made when an imminent and substantial public health or environmental threat exists, based on exposure to local residents, contamination of drinking water supplies, or other similar circumstances. Alternately, a decision that a longer term remedial response is adequate to address the release may be made. A Site Inspection is then performed to further characterize the release. The collection of data enables scoring of the site by the Hazard Ranking System (HRS), a numerical scoring system, which determine priorities among sites for remediation. Sites which score above a certain numerical bench mark are placed on the National Priority List (NPL), and are eligible for funding under CERCLA for remediation. These sites are commonly referred to as "Superfund" sites.

Sites on the NPL undergo a Remedial Investigation and Feasibility Study (RI/FS) to further determine the nature and extent of the site's threat, and to develop and evaluate possible remedial actions. Several options for remedial action are developed and examined in light of a number of factors. The option chosen must fulfil certain criteria: it must consider technical feasibility and reliability, it usually must attain or exceed applicable or relevant and appropriate requirements (such as drinking water standards), must be cost-effective, and must effectively mitigate threats to receptors.

MICHIGAN

The Michigan Hazardous Waste Management Act (Act 64), along with the federal Solid Waste Disposal Act, provides the legal support for issuance of construction and operating licenses for facilities which treat, store or dispose of hazardous waste. Currently, the state issues the RCRA portions of the joint RCRA/HSWA permit. Since the state is only authorized for the pre-HSWA portion, the USEPA must issue the HSWA portion of the permit. Act 64 mandates a minimum of four inspections per year for licensed facilities. Prior to licensing, facilities are subject to, at least, annual inspection. All licenses require some self-monitoring. In addition, MDNR division staff perform some compliance sampling. Ground water monitoring required around the facility is audited by the state, and, in some cases, waste sampling is also performed. Act 64 provide civil, criminal and administrative remedies for violation.

Michigan Act 64 provides the legal support for managing the Uniform Hazardous Waste Manifest System. Generators of hazardous waste or liquid industrial waste are required to have each waste shipment accompanied by a manifest. The MDNR receives two parts; one from the generator, one from the disposal facility. Both parts are manually and computer edited, and compared. The editing of the manifests by MDNR staff can lead to discoveries of violations. Minor violations are handled directly by the manifest staff; on occasion, referrals are made to the compliance sections of the Law Enforcement Division.

Michigan Act 64 and the Michigan Liquid Industrial Waste Disposal Act (Act 136) are concerned with the licensing of businesses and vehicles which transport liquid and hazardous wastes. The purpose is to ensure that trucks are properly labeled as waste hauling vehicles, that they have adequate insurance, and to maintain a tracking system of the waste from generator to disposer. Once a year, the stationary facilities and vehicles the transporter uses are inspected. Samples of the waste may be taken at the site of generation or disposal or in transit. Most of the enforcement is done by the Law Enforcement or Environmental Enforcement divisions. Civil and criminal penalties are provided by statute as well as administrative remedies through license revocation.

Programs under the Michigan Solid Waste Management Act (Act 641), are aimed at preventing environmental problems from the disposal of solid wastes. Only about one-half of the approximately 325 sites in Michigan come close to meeting the federally established criteria for complying with a solid waste disposal facility. The primary concerns are ground and surface water contamination and other related public health concerns. In monitoring landfills, indicator parameters are used to determine if a discharge is occurring into the ground water. If an increase is noted from the indicator parameters, more in-depth sampling is required. Solid Waste Management units are permitted through this program to accept refuse in licensed areas. Four inspections per year are required, but more may be dictated if the facility is perceived to be a threat.

The Michigan Environmental Response Act (MERA, Act 307), provides for the annual listing of, in priority order, all "sites of environmental contamination" in the state, and recommendations of state funds needed to resolve top priority incidents. The sites are prioritized using a relative ranking system, the Site Assessment System (SAS). SAS is analogous, but not identical, to the federal HRS. As part of the MERA mandate to seek federal response action funds, some sites may be investigated by or with the USEPA's Superfund contractual resources to obtain data for the NPL scoring. Some environmental sampling and monitoring is performed by MDNR or Michigan Department of Public Health staff, but the majority is performed by contractors.

The Michigan Underground Storage Tank Registration Program, established under the Michigan Underground Storage Tank Act (Act 423), requires one-time registration of all tanks of a specified size containing "regulated substances." The substances regulated under this program are the same as discussed under the federal regulations. Registration is designed to

provide more accurate information on the universe of materials being stored underground, and on the potential for contamination resulting from these practices. Standards for registration are established in statute, both state and federal.

The Michigan Resource Recovery Act (Act 366) encourages the conservation of natural resources through the promotion or development of systems to collect, separate, reclaim and recycle materials of value from waste. The Resource Recovery Commission, which was formed from the Act, evaluates the solid waste management policies and activities of the Michigan DNR to assess their impact of waste and resource recovery services, and makes recommendations for the Michigan DNR's waste management activities.

Michigan Act 61, referred to as the Oil and Gas Act, addresses the proper operation of oil and gas production wells and wells for the disposal of saltwater, brine and other oil field wastes. The Act requires that production and operation of the wells must be performed in such a manner as to prevent pollution, damage or destruction of fresh water supplies.

TABLE 1: AMBIENT WATER CRITERIA, GUIDELINES OR OBJECTIVES APPLICABLE TO THE UPPER GREAT LAKES CONNECTING CHANNELS (ug/L)

| PARAMETERS | GLWQA SPECIFIC OBJECTIVE[1] | ONTARIO PWQO[2] | USEPA AWQC ACUTE[3] | USEPA AWQC CHRONIC[3] | USEPA AWCQ HUMAN HEALTH WATER/FISH[4] | USEPA AWQC HUMAN HEALTH FISH[4] |
|---|---|---|---|---|---|---|
| Acenapthene | - | - | 1700* | 520* | - | - |
| Acrolein | - | - | 68 | 21 | 320 | 780 |
| Acrylonitrile | - | - | 7500* | 2600* | 0.058 | 0.65 |
| Aldrin | - | - | 3 | - | 0.74ng/L | 0.79ng/L |
| Aldrin/dieldrin | 0.001 | 0.001 | - | - | - | - |
| Alkalinity | - | - | - | 20,000 | - | - |
| Ammonia (unionizied) | 20 | 20 | pH/temperature dependent | | - | - |
| Antimony | - | - | 9000* | 1600* | 146 | 45,000 |
| Arsenic | 50 | 100 | - | - | 0.0022 | 0.0175 |
| Arsenic (penta) | - | - | 850* | 48* | - | - |
| Arsenic (tri) | - | - | 360 | 190 | - | - |
| Benzene | - | 25(interim) | 5300* | - | 0.66 | 40 |
| Benzidine | - | - | 2500* | - | 0.12ng/L | 0.53ng/L |
| Beryllium | - | 11/1100++ | 130* | 5.3* | 0.0068 | 0.117 |
| BHC | - | - | 100* | - | - | - |
| Cadmium | 0.2 | 0.2 | 3.9+ | 1.1+ | 10 | - |
| Carbon Tetrachloride | - | - | 35,200* | - | 0.4 | 6.94 |
| Chlordane | 0.06 | 0.06 | 2.4 | 0.0043 | 4.6ng/L | 4.8ng/L |
| Chlorinated Benzenes | - | - | 250* | 50* | 488 | - |
| Chlorinated Naphthalenes | - | - | 1600* | - | - | - |
| Chlorine (TRC) | - | 2 | 19 | 11 | - | - |
| Chloroform | - | - | 28,900* | 1240* | 0.19 | 15.7 |
| Chloroalkyl Ethers | - | - | 238,000* | - | - | - |
| 2-Chlorophenol | - | - | 4380* | 2000* | - | - |
| Chloropyrifos | - | 0.001 | 0.083 | 0.041 | - | - |
| 4-Chloro-3-methyl phenol | - | - | 30* | - | - | - |
| Chromium | 50 | 100 | - | - | - | - |
| Chromium (hexa) | - | - | 16 | 11 | 50 | - |
| Chromium (tri) | - | - | 1700+ | 210+ | 170mg/L | 3.433g/L |
| Copper | 5 | 5 | 18+ | 12+ | - | - |
| Cyanide | - | 5 | 22 | 5.2 | 200 | - |
| 2,4-D | - | 4 | - | - | - | - |
| Dalapon | - | 110 | - | - | - | - |
| DDE | - | - | 1050* | - | - | - |
| DDT & Metabolites | 0.003 | 0.003 | - | - | - | - |
| DDT | - | - | 1.1 | 0.001 | 0.24ng/L | 0.24 ng/L |
| Demeton | - | - | - | 0.1 | - | - |

* Insufficient evidence to develop criteria. Value shown is the lowest observed adverse effect level (LOAEL).

\+ Hardness-dependent. Value shown in based on 100mg/L calcium carbonate hardness.

++ Hardness-dependent. Values shown are based on less than, or greater than, 75 mg/L calcium carbonate hardness, respectively.

\# pH-dependent. Value shown is based on a pH of 7.8.

@ Not applicable to Lakes Superior and Huron.

TABLE 1: AMBIENT WATER CRITERIA, GUIDEINES AND OBJECTIVES APPLICABLE TO THE UPPER GREAT LAKES CONNECTING CHANNELS (CONTINUED) ug/L

| PARAMETER | GLWQA SPECIFIC OBJECTIVE[1] | ONTARIO PWQO[2] | USEPA AWQC[3] ACUTE | USEPA AWQC[3] CHRONIC | USEPA AWCQ HUMAN HEALTH WATER/FISH[4] | USEPA AWQC HUMAN HEALTH FISH[4] |
|---|---|---|---|---|---|---|
| Diazinon | 0.08 | 0.08 | - | - | - | - |
| Dibutylphthalate | 4 | 4 | - | - | 35mg/L | 154mg/L |
| Dicamba | - | 200 | - | - | - | - |
| 1,2-Dichlorobenzene | - | 2.5 | - | - | - | - |
| 1,3-Dichlorobenzene | - | 2.5 | - | - | - | - |
| 1,4-Dichlorobenzene | - | 4 | - | - | - | - |
| Dichlorobenzenes | - | - | 1120* | 763* | 400 | 2600 |
| 1,2-Dichloroethane | - | - | 118,000* | 20,000* | 0.94 | 243 |
| Dichloroethylenes | - | - | 11,600* | - | 0.033 | 1.85 |
| 2,4-Dichlorophenol | - | - | 2020* | 365* | 3090 | - |
| Dichlorophenols | - | 0.2 | - | - | - | - |
| Dichloropropane | - | - | 23,000* | 5700* | - | - |
| Dichloropropene | - | - | 6060* | 244* | 87 | 1410 |
| Dieldrin | - | - | 2.5 | 0.0019 | 0.071ng/L | 0.076ng/L |
| 2,4-Dimethylphenol | - | - | 2120* | - | - | - |
| Dinitrotoluene | - | - | 330* | 230* | - | - |
| 1,2-Diphenylhydrazine | - | - | 270* | - | - | - |
| Diquat | - | 0.5 | - | - | - | - |
| Dissolved Oxygen mg/L | 6 | 4-8 | pH/temperature dependent | | - | - |
| Diuron | - | 1.6 | - | - | - | - |
| Diethylhexylphthalate | 0.6 | 0.6 | - | - | 15mg/L | 50mg/L |
| E-Coli (bathing) | - | - | 126/100mL | 126/100mL | - | - |
| Endosulfan | - | 0.003 | 0.22 | 0.056 | 74 | 159 |
| Enterococcus (bathing) | - | - | 33/100mL | 33/100mL | - | - |
| Endrin | 0.002 | 0.002 | 0.18 | 0.0023 | 1 | - |
| Ethylbenzene | - | 700 (interim) | 32,000* | - | 1400 | 3280 |
| Fecal Coliforms (bathing) | - | 100/100mL | - | - | - | - |
| Fenthion | - | 0.006 | - | - | - | - |
| Fluoranthene | - | - | 3890* | - | 42 | 54 |
| Fluoride | 1200 | - | - | - | - | - |
| Guthion | 0.005 | 0.005 | - | 0.01 | - | - |
| Haloethers | - | - | 360* | 122* | - | - |
| Halomethanes | - | - | 11,000* | - | 0.19 | 15.7mg/L |
| Heptachlor & Epoxide | 0.001 | 0.001 | 0.52 | 0.0038 | 0.28ng/L | 0.29ng/L |
| Hexachlorobenzene | - | 0.0065 | - | - | 0.72ng/L | 0.74ng/L |

* Insufficient evidence to develop criteria. Value shown is the lowest observed adverse effect level (LOAEL).

\+ Hardness-dependent. Value shown in based on 100mg/L calcium carbonate hardness.

++ Hardness-dependent. Values shown are based on less, or greater than, 75 mg/L calcium carbonate hardness, respectively.

\# pH-dependent. Value shown is based on a pH of 7.8.

@ Not applicable to Lakes Superior and Huron.

TABLE 1: AMBIENT WATER CRITERIA, GUIDEINES AND OBJECTIVES APPLICABLE TO THE UPPER GREAT LAKES CONNECTING CHANNELS (CONTINUED) ug/L

| PARAMETER | GLWQA SPECIFIC OBJECTIVE[1] | ONTARIO PWQO[2] | USEPA AWQC[3] ACUTE | USEPA AWQC[3] CHRONIC | USEPA AQWC HUMAN HEALTH WATER/FISH4 | USEPA AWQC HUMAN HEALTH FISH4 |
|---|---|---|---|---|---|---|
| Hexachlorobutadiene | - | - | 90* | 9.3* | 0.45 | 50 |
| Hexachlorocyclopentadiene | - | - | 7* | 5.2* | 206 | - |
| Hexachloroethane | - | - | 980* | 540* | 1.9 | 8.74 |
| Hydrogen Sulfide | 2 | 2 | - | 2 | - | - |
| Iron | 300 | 300 | - | 1000 | 300 | - |
| Isophorone | - | - | 117,000* | - | 5200 | 520mg/L |
| Lead | 25@ | 5/25++ | 82+ | 3.2+ | 50 | - |
| Lindane | 0.01 | 0.01 | - | - | - | - |
| Malathion | - | 0.1 | - | 0.1 | - | - |
| Mercury | 0.2 | 0.2 | 2.4 | 0.012 | 0.144 | 0.146 |
| Methoxychlor | 0.04 | 0.04 | - | 0.03 | 100 | - |
| Mirex | <DL | - | - | 0.001 | - | - |
| Monochlorobenzene | - | 15 | - | - | 488 | - |
| Monochlorophenols | - | 7 | - | - | - | - |
| Naphthalene | - | - | 2300* | 620* | - | - |
| Nickel | 25 | 25 | 1400+ | 160+ | 13.4 | 100 |
| Nitrobenzene | - | - | 27,000* | - | 19.8mg/L | - |
| Nitrophenols | - | - | 230* | 150* | - | - |
| Nitrosamines | - | - | 5850* | - | 0.8ng/L | 1.24 |
| "Other" phthalates | 0.2 | 0.2 | - | - | - | - |
| Parathion | 0.008 | 0.008 | 0.065 | 0.013 | - | - |
| PCB | - | 0.001 | 2.0 | 0.014 | 0.079ng/L | 0.079ng/L |
| Pentachlorinated ethanes | - | - | 7240* | 1100* | - | - |
| Pentachlorobenzene | - | 0.03 | - | - | 74 | 85 |
| Pentachlorophenol | - | 0.5 | 20# | 13# | - | - |
| pH | - | - | - | 6.5-9 | - | - |
| Phenol | - | - | 10,200* | 2560* | 3500 | - |
| Phenols (total) | 1 | 1 | - | - | - | - |
| Phthalate esters | - | - | 940* | 3* | - | - |
| Phosphorus (see total P) | - | - | - | - | - | - |
| PAH | - | - | - | - | 0.28ng/L | 0.0311 |
| Pyrethrum | - | 0.01 | - | - | - | - |
| Selenium | 10 | 100 | 20 | 5 | 10 | - |
| Silver | - | 0.1 | 4.1+ | 0.12 | 50 | - |
| Simazine | - | 10 | - | - | - | - |
| Styrene | - | 100 (interim) | - | - | - | - |

* Insufficient evidence to develop criteria. Value shown is the lowest observed adverse effect level (LOAEL).

\+ Hardness-dependent. Value shown in based on 100mg/L calcium carbonate hardness.

++ Hardness-dependent. Values shown are based on less than, or greater than, 75 mg/L calcium carbonate hardness, respectively.

\# pH-dependent. Value shown is based on a pH of 7.8.

@ Not applicable to Lakes Superior and Huron.

TABLE 1: AMBIENT WATER CRITERIA, GUIDEINES AND OBJECTIVES APPLICABLE TO THE UPPER GREAT LAKES CONNECTING CHANNELS (CONTINUED) ug/L

| PARAMETER | GLWQA SPECIFIC OBJECTIVE[1] | ONTARIO PWQO[2] | USEPA AWQC[3] ACUTE | USEPA AWQC[3] CHRONIC | USEPA AWQC HUMAN HEALTH WATER/FISH[4] | USEPA AWQC HUMAN HEALTH FISH[4] |
|---|---|---|---|---|---|---|
| 2378-TCDD | - | - | 0.01* | 0.00001* | 0.013pg/L | 0.014pg/L |
| TDE | - | - | 0.06* | - | - | - |
| Tetrachlorinated ethanes | - | - | 9320* | - | - | - |
| 1,2,3,4-Tetrachlorobenzene | - | 0.1 | - | - | - | - |
| 1,2,3,5-Tetrachlorobenzene | - | 0.1 | - | - | - | - |
| 1,2,4,5-Tetrachlorobenzene | - | 0.15 | - | - | 38 | 48 |
| 1,1,2,2-Tetrachloroethane | - | - | - | 2400* | 0.17 | 10.7 |
| Tetrachloroethylene | - | - | 5280* | 840* | 0.8 | 8.85 |
| Tetrachlorophenols | - | 1 | - | - | - | - |
| Thallium | - | - | 1400* | 40* | 13 | 48 |
| Toluene | - | 250 (interim) | 17,500* | - | 14.3mg/L | 424mg/L |
| Total Diss. Solids (mg/L) | 200 | - | - | - | - | - |
| Total Phosphorus (Lakes) | - | 20 | - | - | - | - |
| Total Phosphorus (River) | - | 30 | - | - | - | - |
| Toxaphene | 0.008 | 0.008 | 0.73 | 0.0002 | 0.71ng/L | 0.73ng/L |
| Toxicity $LC_{50}$, 96 hr | 0.05 | 0.05 | - | - | - | - |
| Trichlorinated Ethanes | - | - | 18,000* | - | - | - |
| 1,2,3-Trichlorobenzene | - | 0.9 | - | - | - | - |
| 1,2,4-Trichlorobenzene | - | 0.5 | - | - | - | - |
| 1,3,5-Trichlorobenzene | - | 0.65 | - | - | - | - |
| 1,1,2-Trichloroethane | - | - | - | 9400* | 0.6 | 41.8 |
| Trichloroethylene | - | - | 45,000* | 21,900* | 2.7 | 80.7 |
| 2,4,6-Trichlorophenol | - | - | - | 970* | 1.2 | 3.6 |
| Trichlorophenols | - | 18 | - | - | - | - |
| Zinc | 30 | 30 | 120+ | 110+ | - | - |

* Insufficient evidence to develop criteria. Value shown is the lowest observed adverse effect level (LOAEL).

\+ Hardness-dependent. Value shown in based on 100mg/L calcium carbonate hardness.

++ Hardness-dependent. Values shown are based on less than, or greater than, 75 mg/L calcium carbonate hardness, respectively.

\# pH-dependent. Value shown is based on a pH of 7.8.

@ Not applicable to Lakes Superior and Huron.

1 Great Lakes Water Quality Agreement (GLWQA) Specific Objectives

2 Ontario (Provincial) Water Quality Objectives

3 USEPA Ambient Water Quality Criteria, freshwater acute and chronic values

4 USEPA Ambient Water Quality Criteria for Human Health, based on consumption of 2 liters of water and 6.5 gm fish per day, or consumption of 6.5 gm fish per day alone.

TABLE 2: DRINKING WATER STANDARDS, OBJECTIVES AND CRITERIA APPLICABLE TO THE UPPER GREAT LAKES CONNECTING CHANNELS (mg/L)

| PARAMETER | USEPA MAXIMUM CONTAMINANT LEVEL (MCL)[1] | USEPA MAXIMUM CONTAMINANT LEVEL GOAL (MCLG)[2] | USEPA SECONDARY MAXIMUM CONTAMINANT LEVEL (MCL)[3] | HEALTH AND WELFARE CANADA MAXIMUM ACCEPTABLE CONCENTRATION (MAC)[4] | ONTARIO MAXIMUM ACCEPTABLE CONCENTRATION (MAC)[5] | ONTARIO MAXIMUM DESIRABLE CONCENTRATION (MDC)[6] |
|---|---|---|---|---|---|---|
| Acrylamide | - | 0* | - | - | - | - |
| Alachlor | - | 0* | - | - | - | - |
| Aldicarb | - | 0.009* | - | 0.009 | - | - |
| Aldrin/Dieldrin | - | - | - | 0.0007 | 0.0007 | - |
| Alpha activity pC/L | 15 | - | - | - | - | - |
| Arsenic | 0.05 | 0.05* | - | 0.05 | 0.05 | - |
| Asbestos (fibers/L) | - | 7.1E+06* | - | - | - | - |
| Atrazine | - | - | - | 0.06(interim) | - | - |
| Azinphos-methyl | - | - | - | 0.02 | - | - |
| Barium | 1 | 1.5* | - | 1 | 1 | - |
| Bendiocarb | - | - | - | 0.04 | - | - |
| Benzene | 0.005 | 0* | - | 0.005 | - | - |
| Benzo(a)pyrene ng/L | - | - | - | 10 (interim) | - | - |
| Beta activity pC/L | 50 | - | - | - | - | - |
| Bladex | - | - | - | 0.01 (interim) | - | - |
| Boron | - | - | - | 5 | 5 | - |
| Bromoxynil | - | - | - | 0.005(interim) | - | - |
| Cadmium | 0.01 | 0.005* | - | 0.005 | 0.005 | - |
| Carbaryl | - | - | - | 0.09 | 0.07 | - |
| Carbofuran | - | 0.036* | - | 0.09 | - | - |
| Carbon Tetrachloride | 0.005 | 0* | - | 0.005 | - | - |
| Chlordane | - | 0* | - | 0.007 | 0.007 | - |
| Chloride | - | - | 250 | - | - | 250 |
| Chlorobenzene | - | 0.06* | - | - | - | - |
| Chloropyrifos | - | - | - | 0.09 | - | - |
| Chromium | 0.05 | 0.12* | - | 0.05 | 0.05 | - |
| Coliforms/100 mL | 1 | - | - | - | - | - |
| Color CU | - | - | 15 | - | - | 5 |
| Copper | - | 1.3* | 1 | 1 | - | 1 |
| Corrosivity | - | - | noncorrosive | - | - | - |
| Cyanazine | - | - | - | 0.01(interim) | - | - |
| Cyanide | - | - | - | 0.2 | 0.2 | - |
| 2,4-D | 0.1 | 0.07* | - | 0.1 | 0.1 | - |
| DDT (total) | - | - | - | 0.03 | 0.03 | - |
| Diazinon | - | - | - | 0.02 | 0.014 | - |
| 1,2-Dibromo-3-chloropropane | - | 0* | - | - | - | - |
| 1,2-Dibromoethane | - | 0* | - | - | - | - |
| Dicamba | - | - | - | 0.12 | - | - |
| 1,2-Dichlorobenzene | - | 0.62* | - | 0.2 | - | - |

TABLE 2: DRINKING WATER STANDARDS, OBJECTIVES AND CRITERIA APPLICABLE TO THE UPPER GREAT LAKES CONNECTING CHANNELS (mg/L) (CONTINUED)

| PARAMETER | USEPA MAXIMUM CONTAMINANT LEVEL (MCL)[1] | USEPA MAXIMUM CONTAMINANT LEVEL GOAL (MCLG)[2] | USEPA SECONDARY MAXIMUM CONTAMINANT LEVEL (MCL)[3] | HEALTH AND WELFARE CANADA MAXIMUM ACCEPTABLE CONCENTRATION (MAC)[4] | ONTARIO MAXIMUM ACCEPTABLE CONCENTRATION (MAC)[5] | ONTARIO MAXIMUM DESIRABLE CONCENTRATION (MDC)[6] |
|---|---|---|---|---|---|---|
| 1,4-Dichlorobenzene | - | - | - | 0.005 | - | - |
| p-Dichlorobenzene | 0.075 | 0.075 | - | - | - | - |
| 1,2-Dichloroethane | 0.005 | 0 | - | - | - | - |
| 1,1-Dichloroethene | 0.007 | 0.007 | - | - | - | - |
| cis1,2-Dichloroethene | - | 0.07* | - | - | - | - |
| transl,2-Dichloroethene | - | 0.07* | - | - | - | - |
| Dichloromethane | - | - | - | 0.05 | - | - |
| 1,2-Dichlorophenol | - | - | - | 0.9 | - | - |
| 1,2-Dichloropropane | - | 0.006* | - | - | - | - |
| Diclofop-methyl | - | - | - | 0.009 | - | - |
| Dimethoate | - | - | - | 0.02(interim) | - | - |
| Diquat | - | - | - | 0.07 | - | - |
| Diuron | - | - | - | 0.15 | - | - |
| Endrin | 0.0002 | - | - | - | 0.0002 | - |
| Epichlorohydrin | - | 0* | - | - | - | - |
| Ethylbenzene | - | 0.68* | - | - | - | - |
| Fluoride | 4 | 4 | 2 | 1.5 | 2.4 | - |
| Foaming Agents | - | - | 0.5 | - | - | - |
| Glyphosate | - | - | - | 0.28(interim) | - | - |
| Heptachlor & Epoxide | - | 0* | - | 0.003 | 0.003 | - |
| Iron | - | - | 0.3 | - | - | 0.3 |
| Lead | 0.05 | 0.02* | - | 0.05 | 0.05 | - |
| Lindane | 0.004 | 0.0002* | - | 0.004 | 0.004 | - |
| Malathion | - | - | - | 0.19 | - | - |
| Manganese | - | - | 0.05 | - | - | 0.05 |
| Mercury | 0.002 | 0.003* | - | 0.001 | 0.001 | - |
| Methane l/m$^3$ | - | - | - | - | - | 3 |
| Methoxychlor | 0.005 | - | - | 0.9 | 0.1 | - |
| Methylparathion | - | - | - | 0.007 | 0.007 | - |
| Metolachlor | - | - | - | 0.05(interim) | - | - |
| Metribuzin | - | - | - | 0.08 | - | - |
| Nitrate (as N) | 10 | 10* | - | 10 | 10 | - |
| Nitrilotriacetic acid | - | - | - | 0.05 | 0.05 | - |
| Nitrite (as N) | - | 1* | - | 1 | 1 | - |
| Nitrogen (organic) | - | - | - | - | - | 0.15 |
| Odor (OT) | - | - | 3 | - | - | inoffensive |
| Paraquat | - | - | - | 0.01(interim) | - | - |
| Parathion | - | - | - | 0.05 | 0.035 | - |
| PCB | - | 0* | - | - | 0.003(interim) | - |
| Pentachlorophenol | - | 0.22* | - | 0.06 | - | - |

TABLE 2: DRINKING WATER STANDARDS, OBJECTIVES AND CRITERIA APPLICABLE TO THE UPPER GREAT LAKES CONNECTING CHANNELS (mg/L) (CONTINUED)

| PARAMETER | USEPA MAXIMUM CONTAMINANT LEVEL (MCL)[1] | USEPA MAXIMUM CONTAMINANT LEVEL GOAL (MCLG)[2] | USEPA SECONDARY MAXIMUM CONTAMINANT LEVEL (MCL)[3] | HEALTH AND WELFARE CANADA MAXIMUM ACCEPTABLE CONCENTRATION (MAC)[4] | ONTARIO MAXIMUM ACCEPTABLE CONCENTRATION (MAC)[5] | ONTARIO MAXIMUM DESIRABLE CONCENTRATION (MDC)[6] |
|---|---|---|---|---|---|---|
| Pesticides (total) | - | - | - | 0.1 | - | - |
| Phenols | - | - | - | - | - | 0.002 |
| pH | - | - | 6.5-8.5 | 6.5-8.5 | - | - |
| Phorate | - | - | - | 0.002(interim) | - | - |
| Radium 226/228 pC/L | 5 | - | - | - | - | - |
| Selenium | 0.01 | 0.045* | - | 0.01 | 0.01 | - |
| Silver | 0.05 | - | - | - | 0.05 | - |
| Simazine | - | - | - | 0.01(interim) | - | - |
| Styrene | - | 0.14* | - | - | - | - |
| Sulfate | - | - | 250 | 500 | - | 500 |
| Sulfide ($H_2S$) | - | - | - | - | - | inoffensive |
| Taste | - | - | - | - | - | inoffensive |
| Temperature $^{o}C$ | - | - | - | - | - | 15 |
| Temephos | - | - | - | 0.28(interim) | - | - |
| Terbofos | - | - | - | 0.001(interim) | - | - |
| Tetrachloroethylene | - | 0* | - | - | - | - |
| 2,3,4,6-Tetrachlorophenol | - | - | - | 0.1 | - | - |
| Toluene | - | 2* | - | - | - | - |
| TDS (Solids) | - | - | 500 | - | - | 500 |
| Total organic carbon | - | - | - | - | - | 5 |
| Total Trihalomethanes | 0.1 | - | - | 0.35 | 0.35 | - |
| Toxaphene | 0.1 | 0* | - | - | 0.005 | - |
| 2,4,5-T | - | - | - | 0.28 | - | - |
| 2,4,5-TP (Silvex) | 0.01 | 0.052* | - | - | 0.01 | - |
| Triallate | - | - | - | 0.23 | - | - |
| 1,1,1-Trichloroethane | 0.2 | 0.2 | - | - | - | - |
| Trichloroethylene | 0.005 | 0 | - | - | - | - |
| 2,4,6-Trichloro-phenol | - | - | - | 0.005 | | |
| Trihalomethanes | - | - | - | 0.35 | - | - |
| Turbidity (TU) | 1 | - | - | 1 | 1 | - |

TABLE 2: DRINKING WATER STANDARDS, OBJECTIVES AND CRITERIA APPLICABLE TO THE UPPER GREAT LAKES CONNECTING CHANNELS (mg/L) (CONTINUED)

| PARAMETER | USEPA MAXIMUM CONTAMINANT LEVEL (MCL)[1] | USEPA MAXIMUM CONTAMINANT LEVEL GOAL (MCLG)[2] | USEPA SECONDARY MAXIMUM CONTAMINANT LEVEL (MCL)[3] | HEALTH AND WELFARE CANADA MAXIMUM ACCEPTABLE CONCENTRATION (MAC)[4] | ONTARIO MAXIMUM ACCEPTABLE CONCENTRATION (MAC)[5] | ONTARIO MAXIMUM DESIRABLE CONCENTRATION (MDC)[6] |
|---|---|---|---|---|---|---|
| Uranium | - | - | - | 0.1 | 0.02(interim) | - |
| Vinyl chloride | 0.002 | 0 | - | - | - | - |
| Xylenes | - | 0.44* | - | - | - | - |
| Zinc | - | - | 5 | - | - | 5 |

* Proposed MCLG

1 U.S. National Primary Drinking Water Regulations, Maximum Contaminant Levels (MCLs) are the enforceable drinking water requirement in the United States.

2 U.S. National Primary Drinking Water Regulations, Maximum Contaminant Level Goals (MCLGs) are purely health-based, nonenforceable guidance.

3 U.S. National Secondary Drinking Water Regulations are non-enforceable goals for drinking water aesthetics.

4 Canadian Maximum Acceptable Concentrations (MACs) are recommended drinking water guidance for Provincial consideration.

5 Ontario Maximum Acceptable Concentrations (MACs) are the enforceable drinking water regulations in Ontario.

6 Ontario Maximum Desirable Concentrations (MDCs) are non-enforceable goals for drinking water aesthetics.

TABLE 3: MICHIGAN RULE 57(2) GUIDELINE LEVELS[1]

| PARAMETER | CONCENTRATION (ug/L) |
|---|---|
| Acetone | 500 |
| Acrolein | 3 |
| Acrylonitrile | 2.2 |
| Ammonia (coldwater) | 20 |
| Ammonia (warmwater) | 50 |
| Aniline | 4 |
| Arsenic | 150 |
| Benzene | 60 |
| Benzidine | 0.0051 |
| Bis-(2-chloroethoxy)methane | 4.6 |
| Cadmium (coldwater) | 0.36+ |
| Carbon Tetrachloride | 27 |
| Chlordane | 0.00053 |
| Chlorine | 6 |
| Chlorobenzene | 71 |
| Chloroform | 43 |
| 2-Chlorophenol | 10 |
| 4-Chlorophenol | 9.3 |
| 4-Chloro-3-Methyl Phenol | 4.4 |
| Chromium | 52+ |
| Chromium, hexavalent | 6 |
| Copper (coldwater) | 20.7+ |
| Cyanide (coldwater) | 4 |
| DDT | 0.00013 |
| 1,2-Dichlorobenzene | 7 |
| 1,3-Dichlorobenzene | 20 |
| 1,4-Dichlorobenzene | 15 |
| 3,3-Dichlorobenzidene | 0.06 |
| 1,2-Dichloroethane | 560 |
| 1,1-Dichloroethylene | 2.6 |
| 2,4-Dichlorophenol | 35++ |
| 1,2-Dichloropropane | 160 |
| Dinoseb | 0.6++ |
| 2,4 Dinitrophenol | 9.8 |
| Di-N-propyl formamide | 63 |
| 1,4-Dioxane | 360 |
| Ethylbenzene | 30 |
| Ethylene Dibromide | 1.1 |
| Ethylene Oxide | 56 |
| Hexachlorobenzene | 0.0019 |

Allowable Levels as of January 15, 1988; values are subject to change.

[1] Concentrations apply to the edge of a site-specific mixing zone.
+ Hardness-dependent; based on a calcium carbonate hardness of 100 mg/L.
++ pH dependent; based on a pH of 7.8.

TABLE 3: MICHIGAN RULE 57(2) GUIDELINE LEVELS[1] (continued)

| PARAMETER | CONCENTRATION (ug/L) |
|---|---|
| Hexachlorocyclopentadiene | 0.5 |
| Hexachloroethane | 13 |
| Lead | 3+ |
| Lindane | 0.097 |
| Methylene chloride | 59 |
| Mercury (methyl) | 0.0006 |
| Naphthalane | 29 |
| Nickel | 78+ |
| PCB | 0.00002 |
| Pentachlorophenol (pH < 8.1) | 16.5+ |
| Pentachlorophenol (pH > 8.1) | 23 |
| Phenol | 230 |
| Selenium | 13 |
| Silver | 0.15 |
| Silvex | 3 |
| Styrene | 19 |
| 2,3,7,8-TCDD | 0.000000014 |
| Tetrachloroethylene | 16 |
| Tetra n-butyl ammonium bromide | 140 |
| 1,2,4-Trichlorobenzene | 22 |
| 1,1,1-Trichloroethane | 117 |
| 1,1,2-Trichloroethane | 65 |
| Trichloroethylene | 94 |
| 2,4,6-Trichlorophenol | 1.5 |
| Toluene | 100 |
| Xylene | 40 |
| Zinc | 97.9+ |

Allowable Levels as of January 15, 1988; values are subject to change.
[1] Concentrations apply to the edge of a site-specific mixing zone.
+ Hardness-dependent; based on a calcium carbonate hardness of 100 mg/L.
++ pH dependent; based on a pH of 7.8.

TABLE 4: FISH CONSUMPTION GUIDELINES, OBJECTIVES, TOLERANCES AND ACTION LEVELS APPLICABLE TO THE GREAT LAKES UPPER CONNECTING CHANNELS (ug/g)

| PARAMETER | GREAT LAKES WATER QUALITY AGREEMENT SPECIFIC OBJECTIVE[1] | USFDA ACTION LEVEL(A) OR TOLERANCE(T)2 | HEALTH & WELFARE CANADA FISH CONSUMPTION ADVISORIES[3] | ONTARIO FISH CONSUMPTION GUIDELINES[4] (Restricted Consumption) | ONTARIO FISH CONSUMPTION GUIDELINES[5] (No Consumption) | MICHIGAN PUBLIC HEALTH FISH CONSUMPTION ADVISORY TRIGGER LEVELS[6] |
|---|---|---|---|---|---|---|
| Aldrin | 0.3 | 0.3(A) | - | - | - | 0.3 |
| Chlordane | - | 0.3(A) | - | - | - | 0.3 |
| Chlordecone | - | 0.3(A) | - | - | - | - |
| 2,4D | - | 1.0(T) | - | - | - | - |
| DDT | 1.0 | - | 5.0 | 5.0 | - | 5.0 |
| Dieldrin | 0.3 | - | - | - | - | 0.3 |
| Diquat | - | 0.1(T) | - | - | - | - |
| Endrin | 0.3 | 0.3(A) | - | - | - | 0.3 |
| Fluridone | - | 0.5(T) | - | - | - | - |
| Glyphosate | - | 0.25(T) | - | - | - | - |
| Heptachlor & Epoxide | 0.3 | 0.3(A) | - | - | - | 0.3 |
| Lead | - | - | - | 1.0 | - | - |
| Lindane | 0.3 | - | - | - | - | - |
| Mercury | 0.5 | 1.0(A) | 0.5 | 0.5 | 1.5 | 0.5 |
| Mirex | <DL | 0.1(A) | 0.1 | 0.1 | - | 0.1 |
| PCBs | 0.1 | 2.0(A) | 2.0 | 2.0 | - | 2.0 |
| Simazine | - | 12.0(T) | - | - | - | - |
| Toxaphene | - | - | - | - | - | 5.0 |
| Triclopyr | - | 0.2(T) | - | - | - | - |
| 2378-TCDD (ppt) | - | 25[7] (limited consumption) | 20 | 20 | - | 10 |
| 2378-TCDD (ppt) | - | 50[7] (no consumption) | | | | |

1 The GLWQA specific objectives refers to concentrations in the edible portion of fish, wet weight, for all contaminants except DDT, mercury and PCBs, which are for whole fish concentrations.

2 FDA Action Levels and Tolerances are based on edible portions of fish.

3 Health and Welfare requirements are for fish in commerce only.

4 Ontario Fish Consumption Guidelines are based on a skinless dorsal fillet. Restricted consumption guidelines: unrestricted consumption below and restricted consumption above this guideline, except for women of child-bearing age and children under 15 years of age, where restricted consumption below and no consumption above this guideline is recommended.

5 No consumption is recommended above this guideline for all populations.

6 Michigan Trigger Levels are based on analyses from skin-on fillets or skinless fillets, depending on fish type.

7 USFDA limits for 2,3,7,8-tetrachlorodibenzo(p)dioxin (2378-TCDD) are guidance only.

<DL Less than detectable.

TABLE 5: ONTARIO INDUSTRIAL EFFLUENT OBJECTIVES

| PARAMETER | ONTARIO INDUSTRIAL EFFLUENT OBJECTIVE |
|---|---|
| Ammonia-Nitrogen mg/L | 10 |
| $BOD_5$ mg/L[1] | 15 |
| Cadmium mg/L | 0.001 |
| Chromium mg/L | 1.0 |
| Copper mg/L | 1.0 |
| Fecal Coliforms MF/100mL | - |
| Lead mg/L | 1.0 |
| Mercury mg/L | 0.001 |
| Nickel mg/L | 1.0 |
| Oil and Grease mg/L | 15 |
| pH | 5.5-9.5 |
| Phenols mg/L | 0.02 |
| Phosphorus mg/L | - |
| Suspended Solids mg/L | 15 |
| Tin mg/L | 1.0 |
| Total Residual Chlorine mg/L | - |
| Zinc mg/L | 1.0 |

[1] 5-day biological oxygen demand

TABLE 6: ONTARIO MUNICIPAL AND INDUSTRIAL STRATEGY FOR ABATEMENT (MISA) TIMETABLE

| SECTOR | START DATE | COMPLIANCE WITH MONITORING | COMPLIANCE WITH LIMITS |
|---|---|---|---|
| Petroleum Refining | Apr 1986 | Jan 1988 | Jul 1989 |
| Organic Chemicals | May 1986 | Apr 1988 | Oct 1989 |
| Metal Mining & Refining | Dec 1986 | Jul 1988 | Jan 1990 |
| Industrial Minerals | Dec 1986 | Jul 1988 | Jan 1980 |
| Pulp and Paper | Nov 1986 | Sep 1988 | Mar 1990 |
| Iron and Steel | Feb 1987 | Jan 1989 | Jul 1990 |
| Electric Power Generation | Apr 1987 | Nov 1988 | May 1990 |
| Inorganic Chemicals | Sep 1987 | Jan 1989 | Jun 1990 |
| Casting | Aug 1987 | May 1989 | Nov 1990 |
| Municipal Sewage Treatment | May 1986 | Apr 1989 | Dec 1990 |

Note: These dates are subject to change.

TABLE 7: REVISED ONTARIO EFFLUENT GUIDELINEES FOR WASTEWATER TREATMENT FACILITIES (MOE POLICY 08-01)

| TREATMENT | BIOLOGICAL OXYGEN DEMAND | SUSPENDED SOLIDS | TOTAL PHOSPHORUS (mg/L) |
|---|---|---|---|
| PRIMARY | | | |
| without P removal | 30% removal | 50% removal | - |
| with P removal | 50% removal | 70% removal | 1.0 |
| SECONDARY | | | |
| without P removal | 25 mg/L | 25 mg/L | - |
| with P removal | 25 mg/L | 25 mg/L | 1.0 |
| CONTINUOUS DISCHARGE LAGOON | | | |
| without P removal | 30 mg/L | 40 mg/L | - |
| with P removal | 30 mg/L | 40 mg/L | 1.0 |
| SEASONAL DISCHARGE LAGOON | | | |
| with P removal | 30 mg/L | 40 mg/L | - |
| continuous P removal | 30 mg/L | 40 mg/L | 1.0 |
| batch P removal | 25 mg/L | 25 mg/L | 1.0 |

Note: "Where warranted, a higher degree of treatment shall be required to meet the site-specific effluent requirements developed for each particular receiving water."

Table Adapted from "Report to the Great Lakes Water Quality Board, Guidance on Characterization of Toxic Substances Problems in Areas of Concern in the Great Lakes Basin.", March, 1987.

TABLE 8: GUIDELINES AND CRITERIA FOR AGRICULTURAL APPLICATION OF WASTEWATER SLUDGE

| PARAMETER | ONTARIO MAXIMUM PERMISSIBLE CONCENTRATION (mg/kg solids)[1] | MICHIGAN GUIDELINES FOR APPLICATION OF WASTEWATER SLUDGE | | |
|---|---|---|---|---|
| | | CLASS 1[2] | CLASS 2[3] | CLASS 3[4] |
| Arsenic | 170 | 100 | 100-2000 | 2000 |
| Cadmium | 34 | 5 | 5-125 | 125 |
| Chromium | 2800 | 50 | 50-5000 | 5000 |
| Cobalt | 340 | - | - | - |
| Copper | 1700 | 250 | 250-2000 | 2000 |
| Lead | 1100 | 250 | 250-2000 | 2000 |
| Mercury | 11 | 2 | 2-10 | 10 |
| Molybdenum | 94 | 10 | 10-50 | 50 |
| Nickel | 420 | 25 | 25-1000 | 1000 |
| PCB | - | 1 | 1-10 | NA |
| Selenium | 34 | 10 | 10-80 | 80 |
| Zinc | 4200 | 750 | 750-5000 | 5000 |

1 For all aerobic sewage sludge and dried/dewatered anaerobic sewage sludge; other regulations apply for liquid anaerobic sludge.

2 May be applied to all manner of crops with little restrictions on use.

3 May be applied to crops in accordance with computed site limitations on annual and lifetime metals accumulation.

4 May only be applied to crop lands under carefully controlled rates which are consistent with computed site assimilation rates; sludges containing greater than 10 ppm PCB may not be land-applied.

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TABLE 9: AMBIENT AIR QUALITY STANDARDS, OBJECTIVES AND CRITERIA APPLICABLE TO THE UPPER GREAT LAKES CONNECTING CHANNELS[1]

| PARAMETER | USEPA NAAQS[2] Primary Standard | USEPA NAAQS[3] Secondary Standard | CANADA AAQO[4] Maximum Desirable Conc. | CANADA AAQO[5] Maximum Acceptable Conc. | CANADA AAQO[6] Maximum Tolerable Conc. | ONTARIO AAQC[7] |
|---|---|---|---|---|---|---|
| Sulfur Oxides ug/m$^3$ | | | | | | |
| Annual Arith. Mean | 80 | - | - | - | - | - |
| Max 24hr Conc. | 365 | - | - | - | - | - |
| Max. 3hr Conc. | - | 1300 | - | - | - | - |
| Sulfur Dioxide ug/m$^3$ | | | | | | |
| Annual Arith. Mean | - | - | 30 | 60 | - | 55 |
| 24 hr Avg. | - | - | 150 | 300 | 800 | 275 |
| 1 hr Avg. | - | - | 450 | 900 | - | 690 |
| PM-10* ug/m$^3$ | | | | | | |
| Annual Geo. Mean | 50 | 50 | 60 | 70 | - | 60 |
| Max. 24hr Conc. | 150 | 150 | - | - | - | - |
| 24hr Avg. | - | - | - | 120 | 400 | 120 |
| Carbon Monoxide mg/m$^3$ | | | | | | |
| 8hr Avg. | 10 | - | 6 | 15 | 20 | 15.7 |
| 1hr Avg. | 40 | - | 15 | 35 | - | 36.2 |
| Ozone ug/m$^3$ | | | | | | |
| Annual Avg. | - | - | - | 30 | - | - |
| 24hr Avg. | - | - | 30 | 50 | - | - |
| 1hr Avg. | - | - | 100 | 160 | 300 | 165 |
| Expected days per year w/Maximum Conc = 0.12ppm | 235 | 235 | - | - | - | - |

* Particulate matter with an aerodynamic diameter of 10 microns or less.

1 This table is a simplified version of the regulations, which should be consulted for complete information.

2 US National Ambient Air Quality Standards - Primary standards are for the protection of public health.

3 US NAAQS - Secondary standards are for the protection of materials and aesthetics.

4 Canadian Ambient Air Quality Objectives, Maximum Desirable Conc:

5 Canadian Ambient Air Quality Objectives, Maximum Acceptable Conc:

6 Canadian Ambient Air Quality Objectives, Maximum Tolerable Conc:

7 Ontario Ambient Air Quality Criteria; contains criteria for other parameters as well, including dustfall, gaseous fluorides, total fluorides, mercaptans and soiling. See regulations for specifics.

TABLE 9: AMBIENT AIR QUALITY STANDARDS, OBJECTIVES AND CRITERIA APPLICABLE TO THE UPPER GREAT LAKES CONNECTING CHANNELS (continued)[1]

| PARAMETER | USEPA NAAQS[2] Primary Standard | USEPA NAAQS[3] Secondary Standard | CANADA AAQO[4] Maximum Desirable Conc. | CANADA AAQO[5] Maximum Acceptable Conc. | CANADA AAQO[6] Maximum Tolerable Conc. | ONTARIO AAQC[7] |
|---|---|---|---|---|---|---|
| Nitrogen Dioxide ug/m$^3$ | | | | | | |
| Annual Arith. Mean | 100 | 100 | 60 | 100 | - | - |
| 24 hr Avg. | - | - | - | 200 | 300 | 200 |
| 1 hr. Avg. | - | - | - | 400 | 1000 | 400 |
| Arsenic ug/m$^3$ | | | | | | |
| 24hr Avg. | - | - | - | - | - | 25 |
| Cadmium ug/m$^3$ | | | | | | |
| 24hr Avg. | - | - | - | - | - | 2 |
| Lead ug/m$^3$ | | | | | | |
| Quarterly Avg. | 1.5 | 1.5 | - | - | - | - |
| 30 day Geo. Mean | - | - | - | - | - | 2 |
| 24hr Avg. | - | - | - | - | - | 5 |
| Mercury ug/m$^3$ | | | | | | |
| 24hr Avg. | - | - | - | - | - | 2 |
| Nickel ug/m$^3$ | | | | | | |
| 24hr Avg. | - | - | - | - | - | 2 |
| Total Oxidants ppm(v/v) | | | | | | |
| 1hr Avg. | - | - | - | - | - | 0.08 |
| Vanadium ug/m$^3$ | | | | | | |
| 24hr Avg. | - | - | - | - | - | 2 |

1 This table is a simplified version of the regulations, which should be consulted for complete information.
2 US National Ambient Air Quality Standards - Primary standards are for the protection of public health.
3 US NAAQS - Secondary standards are for the protection of materials and aesthetics.
4 Canadian Ambient Air Quality Objectives, Maximum Desirable Conc:
5 Canadian Ambient Air Quality Objectives, Maximum Acceptable Conc:
6 Canadian Ambient Air Quality Objectives, Maximum Tolerable Conc:
7 Ontario Ambient Air Quality Criteria; contains criteria for other parameters as well, including dustfall, gaseous fluorides, total fluorides, mercaptans and soiling. See regulations for specifics.

TABLE 10: USEPA, ONTARIO MINISTRY OF THE ENVIRONMENT AND GREAT LAKES WATER QUALITY BOARD SEDIMENT DREDGING GUIDELINES (mg/kg)

| PARAMETER | ONTARIO MOE GUIDELINES[1] | USEPA GUIDELINES[2] Nonpolluted | USEPA GUIDELINES[2] Moderately | USEPA GUIDELINES[2] Heavily | GLWQB DREDGING GUIDELINES[3] Lake Huron | GLWQB DREDGING GUIDELINES[3] Lake Erie |
|---|---|---|---|---|---|---|
| Total Phosphorus | 1000 | <420 | 420-650 | >650 | 570 | 960 |
| Total Kjeldahl Nitrogen | 2000 | <1000 | 1000-2000 | >2000 | - | - |
| Ammonia | 100 | <75 | 75-200 | >200 | - | - |
| Volatile Solids | 60,000 | <50,000 | 50,000-80,000 | >80,000 | - | - |
| Chemical Oxygen Demand | 50,000 | <40,000 | 40,000-80,000 | >80,000 | - | - |
| Oil & Grease | 1500 | <1000 | 1000-2000 | >2000 | - | - |
| Arsenic | 8 | <3 | 3-8 | >8 | 1.1 | 3.2 |
| Barium | - | <20 | 20-60 | >60 | - | - |
| Cadmium | 1 | - | - | >6 | 1.4 | 2.5 |
| Chromium | 25 | <25 | 25-75 | >75 | 32 | 53 |
| Cobalt | 50 | - | - | - | - | - |
| Copper | 25 | <25 | 25-50 | >50 | 32 | 39 |
| Cyanide | 0.1 | <0.1 | 0.1-0.25 | >0.25 | - | - |
| Iron | 10,000 | <17,000 | 17,000-25,000 | >25,000 | - | - |
| Lead | 50 | <40 | 40-60 | >60 | 49 | 112 |
| Manganese | - | <300 | 300-500 | >500 | - | - |
| Mercury | 0.3 | | >1 ("Polluted") | | 0.22 | 0.58 |
| Nickel | 25 | <20 | 20-50 | >50 | 39 | 49 |
| PCB | 0.05 | | >10("Polluted") | | 0.009-0.033 | 0.074-0.252 |
| Silver | 0.5 | - | - | - | - | - |
| Selenium | - | - | - | - | 0.9 | 0.79 |
| Zinc | 100 | <90 | 90-200 | >200 | 62 | 177 |

1 Ontario Ministry of the Environment Guidelines for Dredge Spoils for Open Water Disposal

2 USEPA Guidelines for the Pollutional Classification of Great Lakes Harbor Sediments

3 Guidelines for the Evaluation of Great Lakes Dredging Projects, Dredging Subcommittee, Great Lakes Water Quality Board